

2006 Buick Lucerne CXS

2006 BRAKES Antilock Brake System - Lucerne

2006 BRAKES

Antilock Brake System - Lucerne

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Brake Pipe Fitting at Pressure Modular - Master Cylinder - Tube Nut	27 N.m	20 lb ft
Brake Pipe Fitting at Pressure Modular - Tube Nut	18 N.m	13 lb ft
Brake Pressure Modulator Valve (BPMV) Bracket Mounting Bolts	12 N.m	106 lb in
BPMV to Bracket Mounting Bolt	10 N.m	89 lb in
Electronic Brake Control Module (EBCM) to BPMV Mounting Screws	3 N.m	27 lb in
Yaw Rate Lateral and Longitudinal Accelerometer Nuts	9 N.m	80 lb in

SCHEMATIC AND ROUTING DIAGRAMS

ANTILOCK BRAKE SYSTEM SCHEMATIC ICONS

Antilock Brake System Schematic Icons

Icon	Icon Definition
	<p>IMPORTANT:</p> <p>Twisted-pair wires provide an effective shield that helps protect sensitive electronic components from electrical interference. If the wires were covered with shielding, install new shielding.</p> <p>In order to prevent electrical interference from degrading the performance of the connected components, you must maintain the proper specification when making any repairs to the twisted-pair wires shown :</p> <ul style="list-style-type: none">• The wires must be twisted a minimum of 9 turns per 31 cm (12 in) as measured anywhere along the length of the wires.• The outside diameter of the twisted wires must not exceed 6.0 mm (0.25 in).



ANTILOCK BRAKE SYSTEM SCHEMATICS

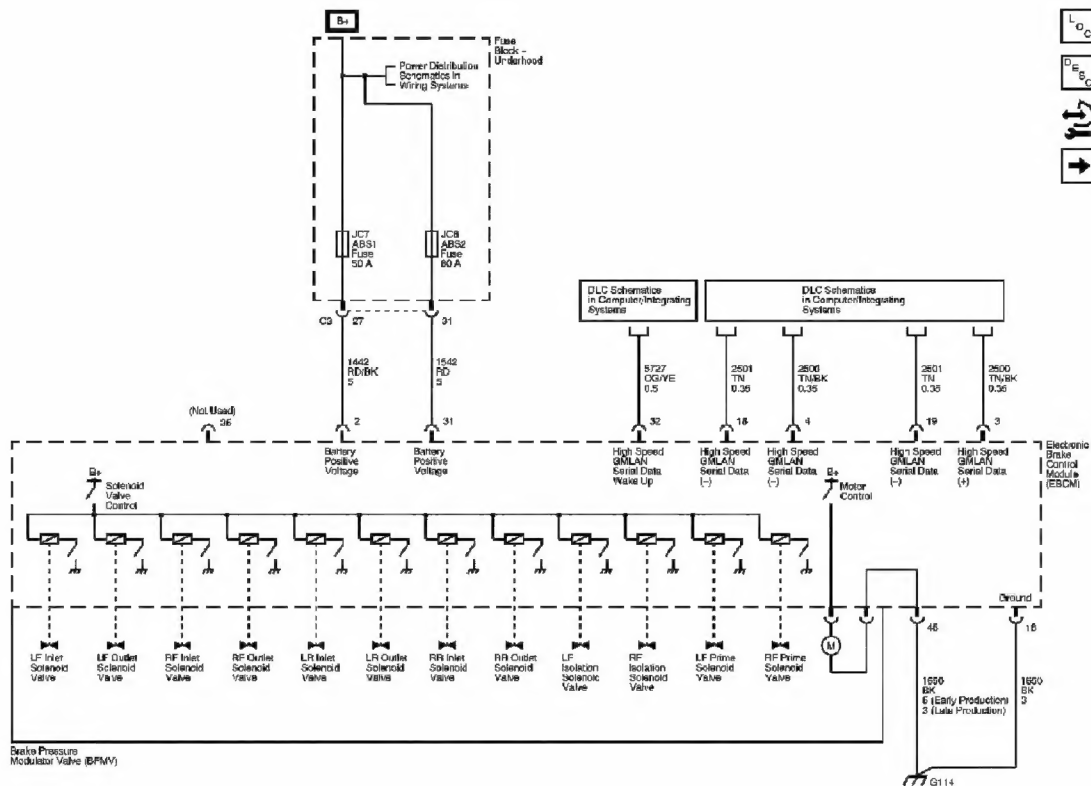


Fig. 1: Power & Ground Schematic
Courtesy of GENERAL MOTORS CORP.

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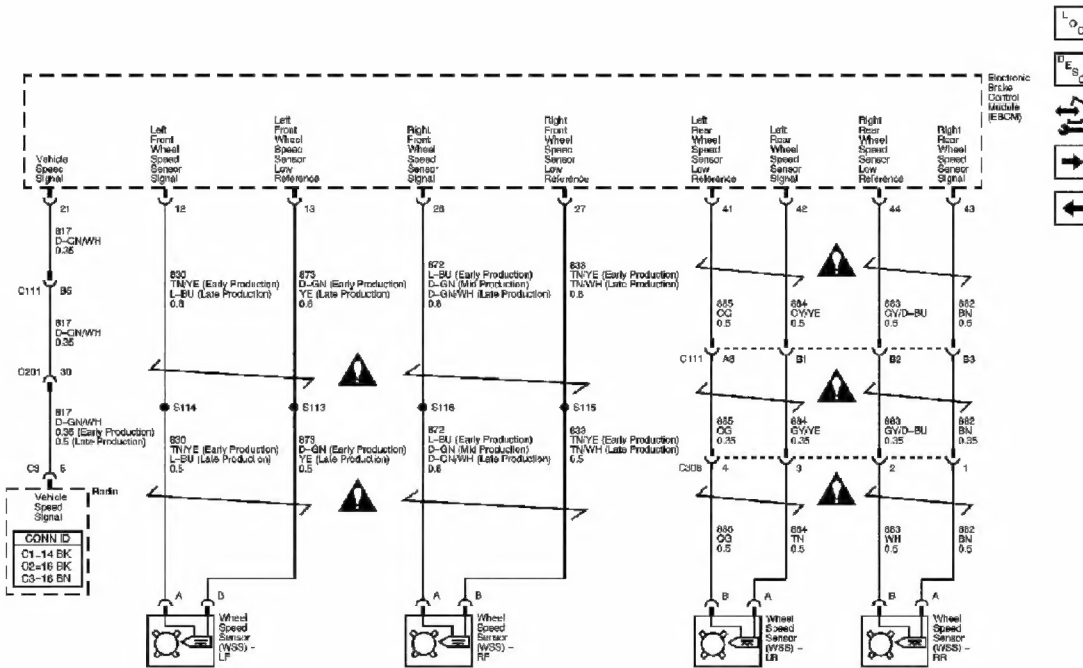


Fig. 2: Wheel Speed Sensors Schematic
Courtesy of GENERAL MOTORS CORP.

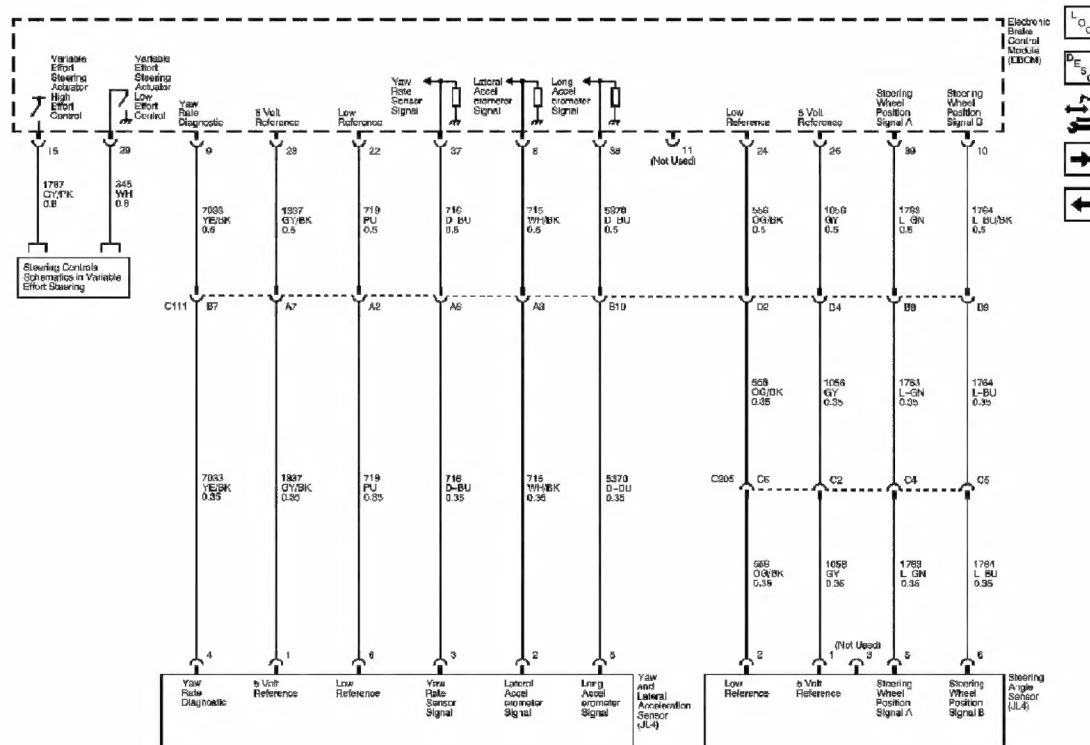


Fig. 3: Yaw & Lateral Acceleration, Steering Angle Sensor Schematic
Courtesy of GENERAL MOTORS CORP.

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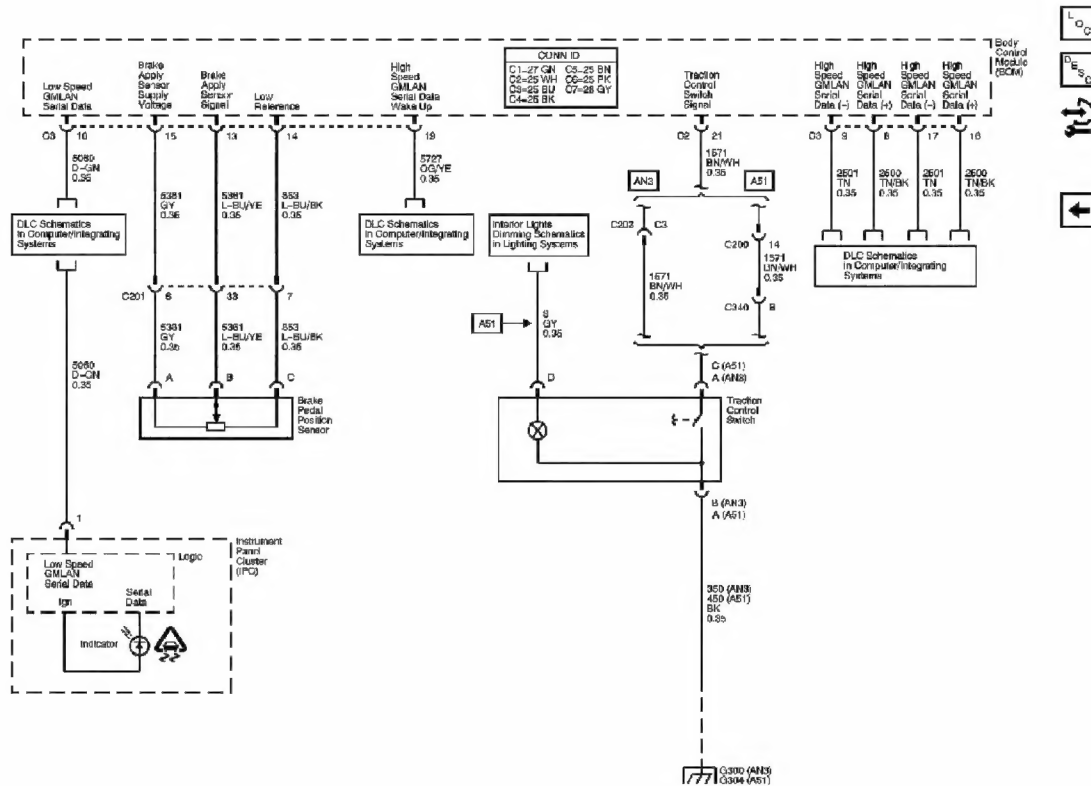


Fig. 4: Brake Pedal Position, Traction Control Switch & Data Link Communications Schematic

Courtesy of GENERAL MOTORS CORP.

COMPONENT LOCATOR

ANTILOCK BRAKE SYSTEM COMPONENT VIEWS

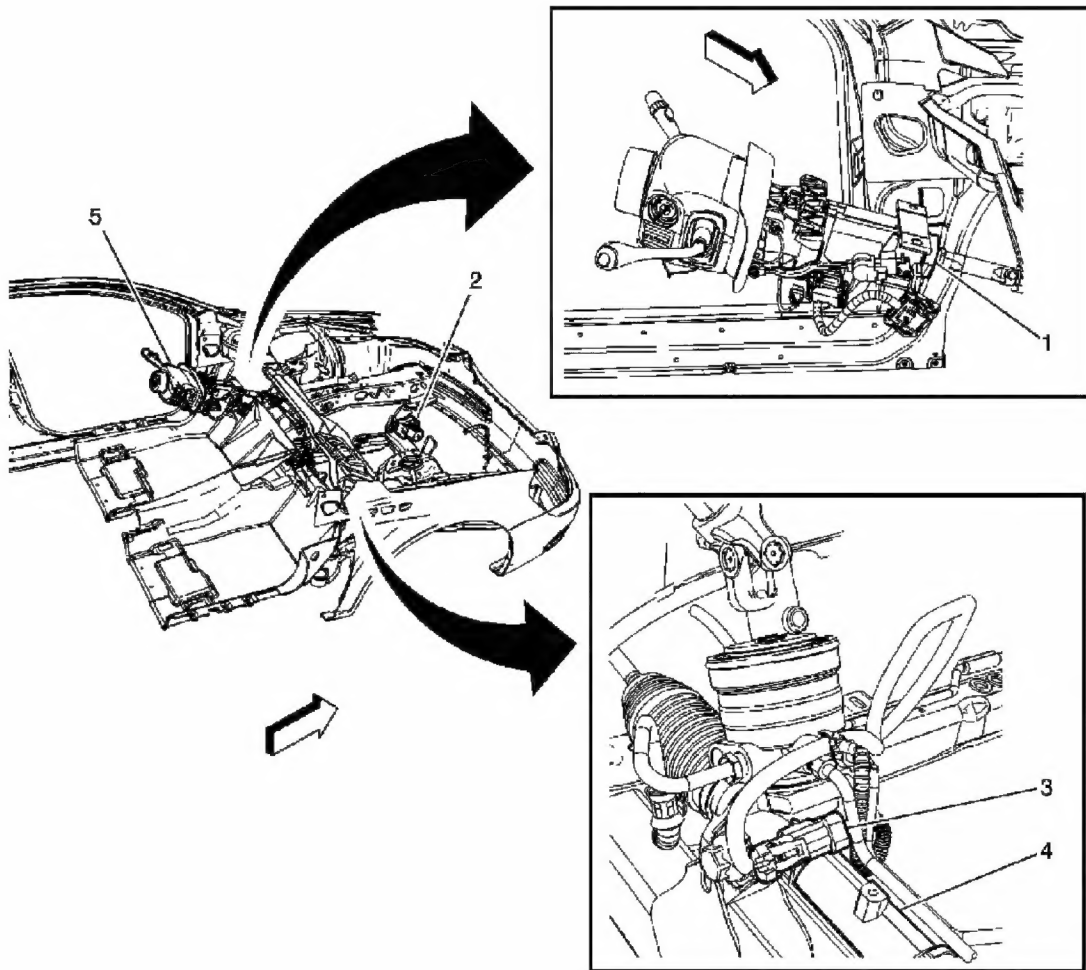


Fig. 5: Identifying Power Steering Components
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 5

Callout	Component Name
1	Steering Angle Sensor (JL4)
2	Electronic Brake Control Module (EBCM)
3	Variable Effort Steering Actuator
4	Power Steering Rack
5	Steering Column Assembly

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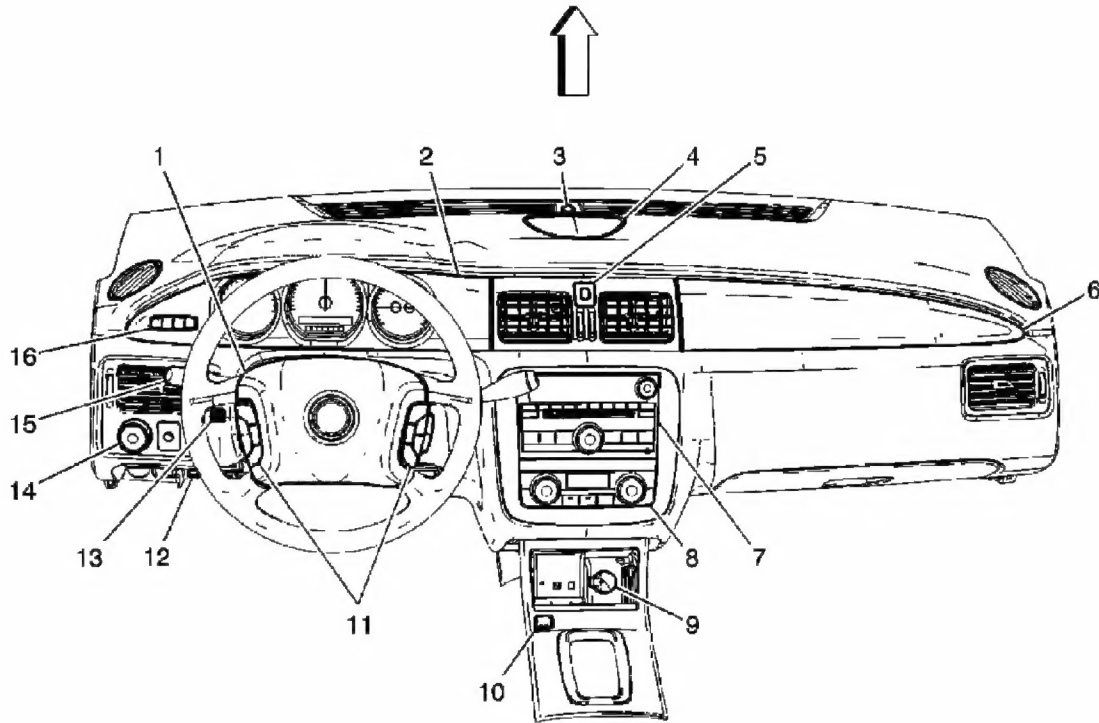


Fig. 6: Identifying Instrument Panel (I/P) Components
Courtesy of **GENERAL MOTORS CORP.**

Callouts For Fig. 6

Callout	Component Name
1	Inflatable Restraint Steering Wheel Module
2	Instrument Panel Cluster (IPC)
3	Sunload Twilight Sensor
4	Speaker - Front Center (UQA)
5	Hazard Switch
6	Inflatable Restraint I/P Module
7	Radio
8	HVAC Control Module
9	Auxiliary Power Outlet - Console (A51)/Cigar Lighter (DT4 w/A51)
10	Traction Control Switch
11	Steering Wheel Controls
12	Data Link Connector (DLC)
13	Air Temperature Sensor - Inside (CJ2)
14	Headlamp Switch
15	Turn Signal/Multifunction Switch
16	Driver Information Display Switch

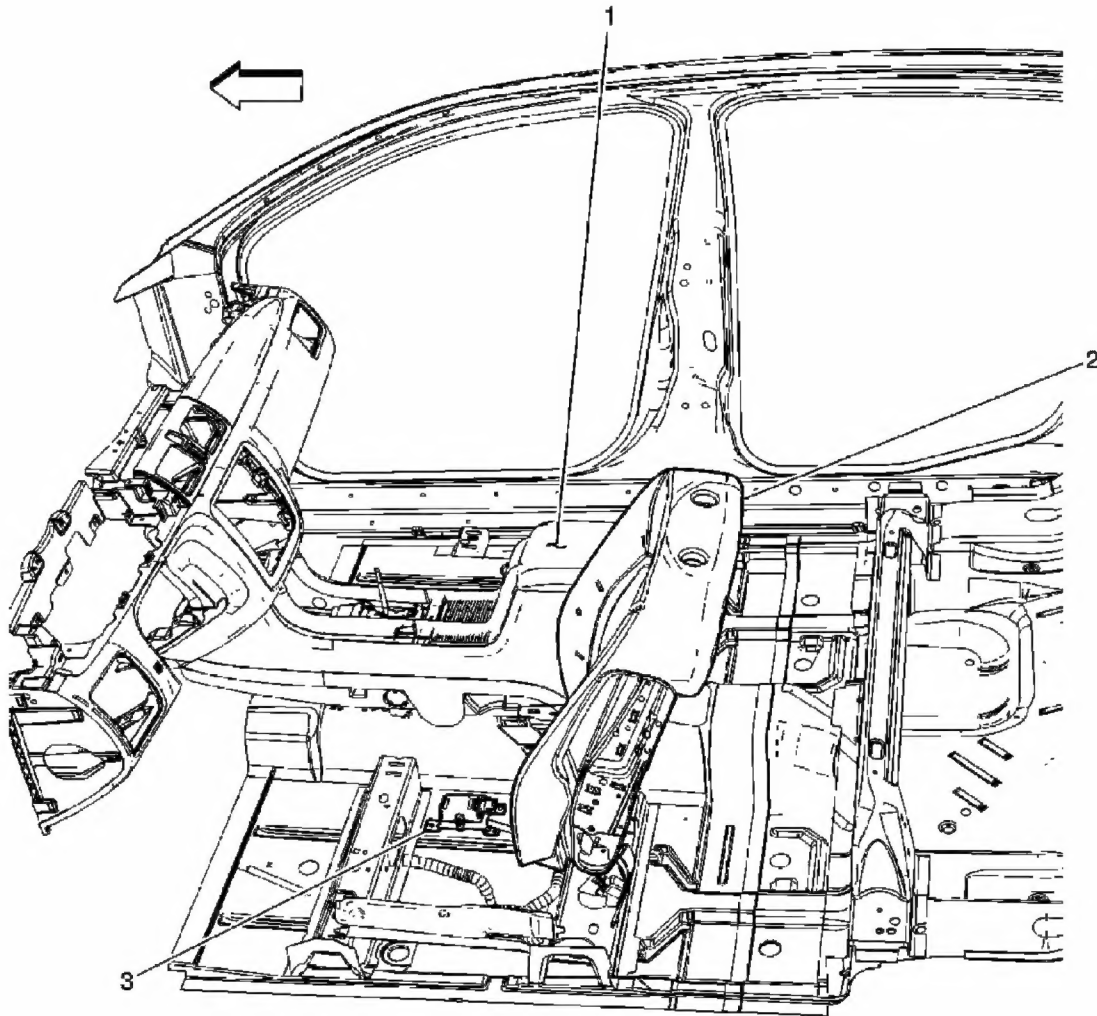


Fig. 7: Identifying Components Underneath Drivers Seat
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 7

Callout	Component Name
1	Floor Console
2	Driver Seat Back Cushion
3	Yaw and Lateral Acceleration Sensor (JL4)

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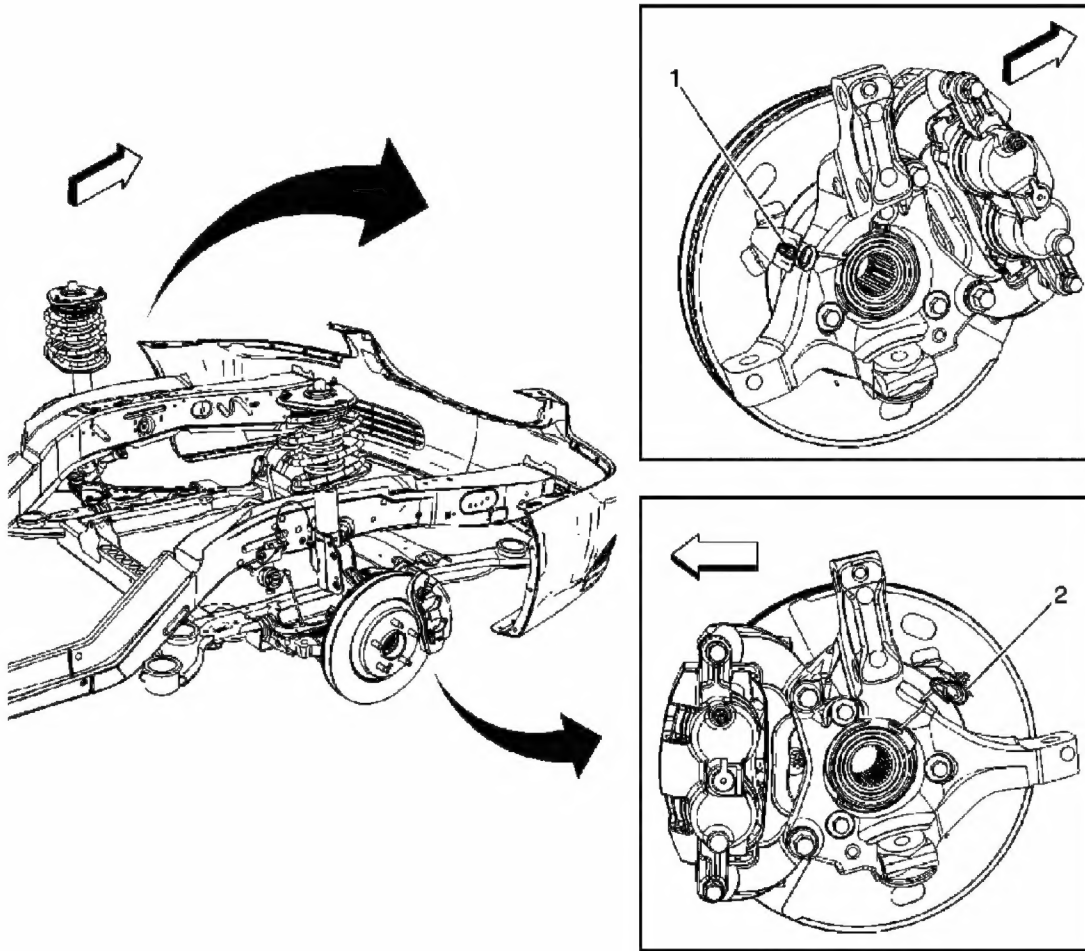


Fig. 8: Identifying Front Wheel Speed Sensors
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 8

Callout	Component Name
1	Wheel Speed Sensor (WSS)-LF
2	Wheel Speed Sensor (WSS)-RF

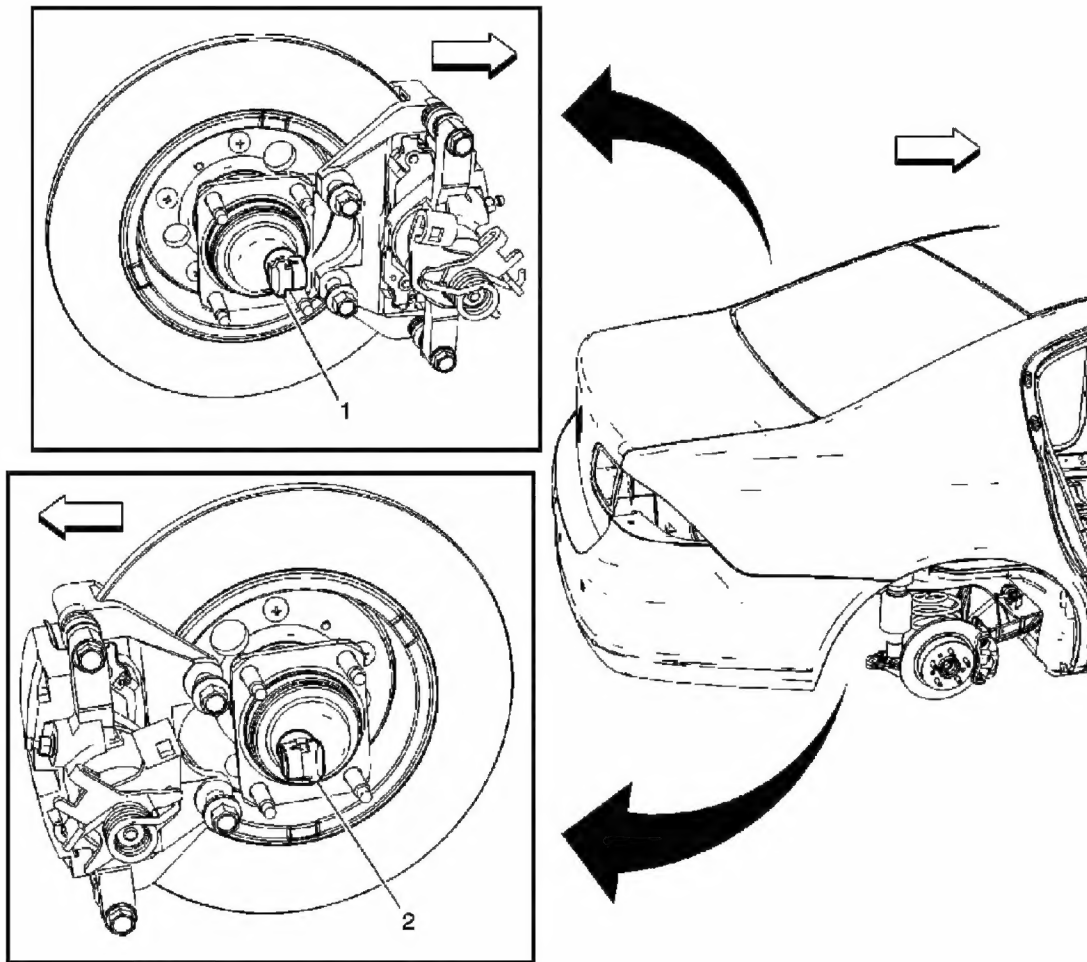


Fig. 9: Identifying Rear Wheel Speed Sensors
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 9

Callout	Component Name
1	Wheel Speed Sensor (WSS)-LR
2	Wheel Speed Sensor (WSS)-RR

ANTILOCK BRAKE SYSTEM CONNECTOR END VIEWS

Electronic Brake Control Module (EBCM)

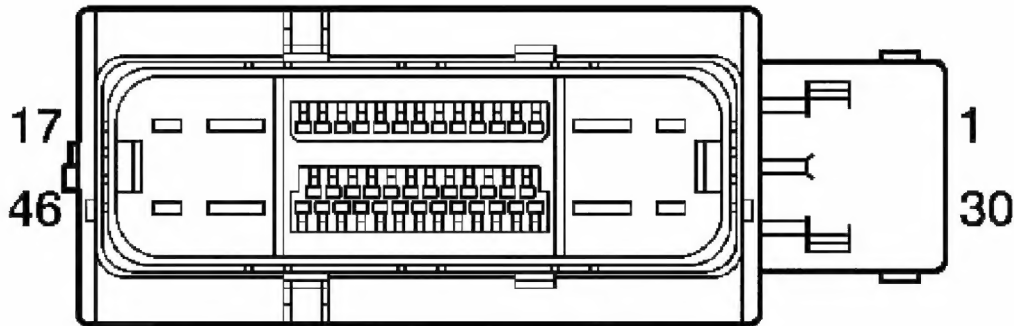


Fig. 10: Electronic Brake Control Module (EBCM) Connector End View
Courtesy of GENERAL MOTORS CORP.

Antilock Brake System Connector End Views

Connector Part Information

- OEM: 3-1326339-7 (JL4), 3-1326339-5 (w/o JL4)
- Service: See Catalog
- Description: 46-Way (BK)

Terminal Part Information

- Pins: 2, 16, 31, 45
- Terminal/Tray: 7116-4142-02/10
- Core/Insulation Crimp: D/3
- Release Tool/Test Probe: 12094430/J-35616-42 (RD)
- Pins: 3, 4, 8, 9, 10, 12, 12, 13, 13, 15, 18, 19, 22, 23, 24, 25, 26, 26, 27, 27, 29, 32, 37, 38, 39, 41, 42, 43, 44, 21
- Terminal/Tray: 638551-1/16
- Core/Insulation Crimp: Pins 3, 4, 8, 9, 10, 12, 12, 13, 13, 15, 18, 19, 22, 23, 24, 25, 26, 26, 27, 27, 29, 32, 37, 38, 39, 41, 42, 43, 44 - K/K
- Core/Insulation Crimp: Pins 21 - J/J
- Release Tool/Test Probe: 15315247/J-35616-64B (L-BU)

Electronic Brake Control Module (EBCM)

Pin	Wire Color	Circuit No.	Function
1	-	-	Not Used

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2	RD/BK	1442	Battery Positive Voltage
3	TN/BK	2500	High Speed GMLAN Serial Data Bus +
4	TN/BK	2500	High Speed GMLAN Serial Data Bus +
5-7	-	-	Not Used
8	WH/BK	715	Lateral Accelerometer Signal (JL4)
9	YE/BK	7033	Yaw Rate Diagnostic (JL4)
10	L-BU/BK	1764	Steering Wheel Position Signal B (JL4)
11	-	-	Not Used
12	TN/YE	830	Left Front Wheel Speed Sensor Signal (Early Production)
	L-BU	830	Left Front Wheel Speed Sensor Signal (Late Production)
	D-GN	873	Left Front Wheel Speed Sensor Low Reference (Early Production)
13	YE	873	Left Front Wheel Speed Sensor Low Reference (Late Production)
14	-	-	Not Used
15	GY/PK	1787	Variable Effort Steering Actuator High Effort Control
16	BK	1650	Ground
17	-	-	Not Used
18	TN	2501	High Speed GMLAN Serial Data Bus -
19	TN	2501	High Speed GMLAN Serial Data Bus -
20	-	-	Not Used
21	D-GN/WH	817	Vehicle Speed Signal
22	PU	719	Low Reference (JL4)
23	GY/BK	1337	5-Volt Reference (JL4)
24	OG/BK	556	Low Reference (JL4)
25	GY	1056	5-Volt Reference (JL4)
26	L-BU	872	Right Front Wheel Speed Sensor Signal (Early Production)
	D-GN	872	Right Front Wheel Speed Sensor Signal (Mid Production)
	D-GN/WH	872	Right Front Wheel Speed Sensor

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Pin	Wire Color	Circuit No.	Signal (Late Production)	Function
1	TN/YE	833	Right Front Wheel Speed Sensor	Right Front Wheel Speed Sensor
2	RD/BK	1442	Low Reference (Early Production)	Battery Positive Voltage
3	TN/BK	830	Right Front Wheel Speed Sensor	Right Front Wheel Speed Sensor
4	TN/BK	2500	High Speed GMLAN Serial Data B	Low Reference (Late Production)
5	WH	345	Variable Effort Steering Actuator	Not Used
6	-	-	Low Effort Control	Not Used
7	WH/BK	715	Lateral Accelerometer Signal (JL4)	Not Used
8	YE/BK	1703	Battery Positive Voltage (JL4)	Low Rate Diagnostic
9	DB/YE	5774	High Speed GMLAN Serial Data B	High Speed GMLAN Serial Data B
10	DB/BK	1764	Steering Wheel Position Signal B	Wake Up
11	-	-	Not Used	Not Used
12	D-BU	716	Yaw Rate Sensor Signal (JL4)	Left Front Wheel Speed Sensor Signal
13	TN/YE	830	Left Front Wheel Speed Sensor	Left Front Wheel Speed Sensor
14	D-BU	5370	Lateral Accelerometer Signal	Left Front Wheel Speed Sensor Signal
15	L-BU	830	Steering Wheel Position Signal A	Steering Wheel Position Signal A
16	L-GN	1763	Left Front Wheel Speed Sensor Low	Left Front Wheel Speed Sensor Low
17	D-GN	873	Reference (Early Production)	Reference (Early Production)
18	-	-	Not Used	Not Used
19	OE	8853	Left Front Wheel Speed Sensor Low	Left Front Wheel Speed Sensor Low
20	OE	8853	Reference (Late Production)	Reference (Late Production)
21	GY/YE	884	Left Front Wheel Speed Sensor	Left Front Wheel Speed Sensor
22	GY/PK	1787	Variable Effort Steering Actuator	Variable Effort Steering Actuator
23	BN	882	Right Front Wheel Speed Sensor	Right Front Wheel Speed Sensor
24	BK	1650	Signal	Signal
25	GY/D-BU	883	Right Front Wheel Speed Sensor Low	Right Front Wheel Speed Sensor Low
26	TN	2501	Reference	Reference
27	BK	1630	Ground	Ground
28	TN	2501	Not Used	Not Used
29	TN	2501	High Speed GMLAN Serial Data B	High Speed GMLAN Serial Data B

Steering Angle Sensor (JL4)

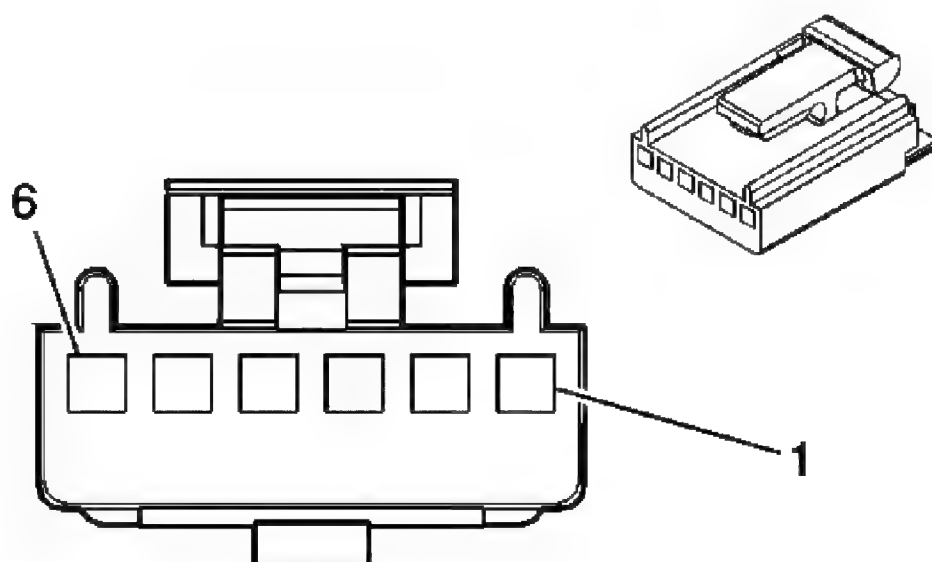


Fig. 11: Steering Angle Sensor (JL4) Connector End View
 Courtesy of GENERAL MOTORS CORP.

Antilock Brake System Connector End Views

Connector Part Information

- OEM: 12064978
- Service: 12125678
- Description: 6-Way F Micro-Pack 100 Series (GY)

Terminal Part Information

- Pins: 1, 2, 5, 6
- Terminal/Tray: See Terminal Repair Kit
- Core/Insulation Crimp: See Terminal Repair Kit
- Release Tool/Test Probe: See Terminal Repair Kit

Steering Angle Sensor (JL4)

Pin	Wire Color	Circuit No.	Function
1	GY	1056	5-Volt Reference
2	OG/BK	556	Low Reference

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3-4	-	-	Not Used
5	L-GN	1763	Steering Wheel Position Signal A
6	L-BU	1764	Steering Wheel Position Signal B

Traction Control Switch (A51)

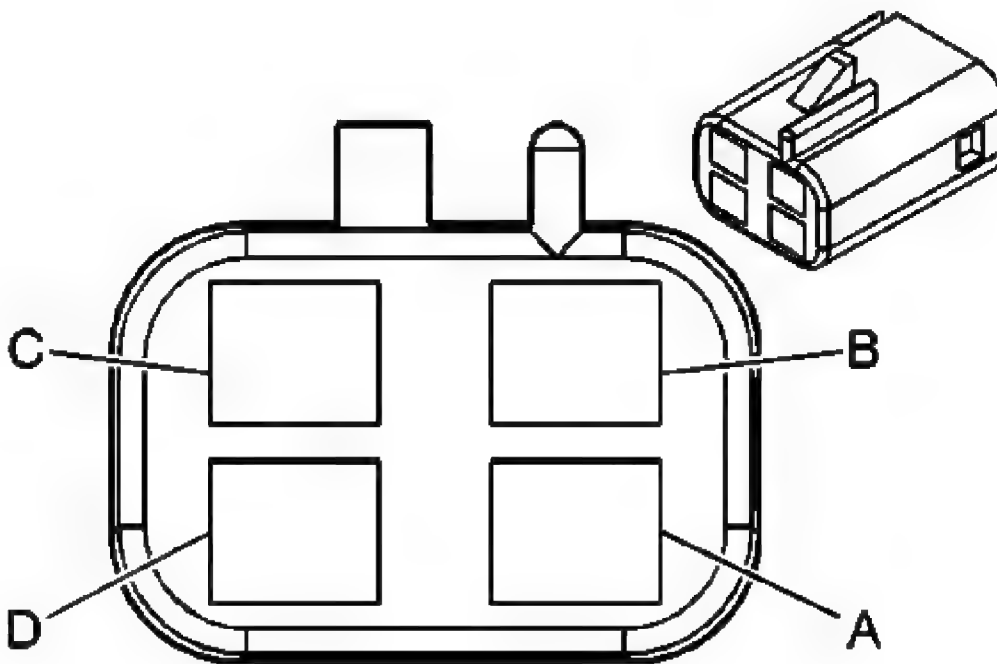


Fig. 12: Traction Control Switch (A51) Connectors End View
Courtesy of GENERAL MOTORS CORP.

Antilock Brake System Connector End Views

Connector Part Information

- OEM: 12047785
- Service: 12102900
- Description: 4-Way F Metri-Pack 150 Series (BK)

Terminal Part Information

- Pins: A, C, D
- Terminal/Tray: 12064971/5
- Core/Insulation Crimp: E/C

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• Release Tool/Test Probe: 12094429/J-35616-2A (GY)

Connector Part Information

Traction Control Switch (A51)

Pin	Wire Color	Circuit No.	Function
A	BK	450	Ground
B	-	-	Not Used
C	BN/WH	1571	Traction Control Switch Signal
D	GY	8	Instrument Panel Lamp Supply Voltage/Instrument Panel Lamps Dimmer Switch Signal

Traction Control Switch (AN3)

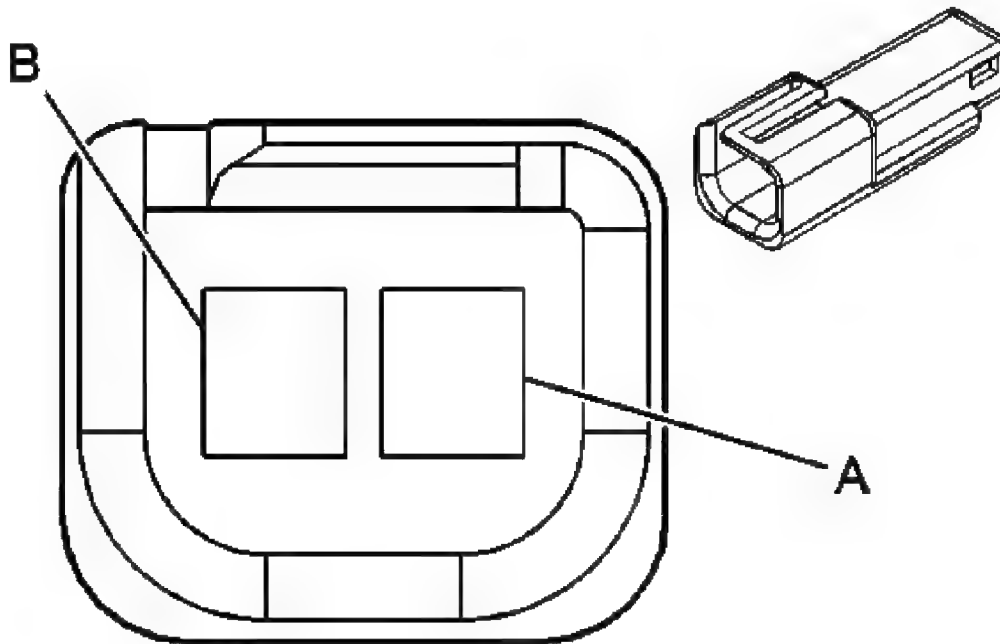


Fig. 13: Traction Control Switch (AN3) Connector End View
Courtesy of GENERAL MOTORS CORP.

Antilock Brake System Connector End Views

Connector Part Information

- OEM: 12059250
- Service: 12085481

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- Description: 2-Way M Metri-Pack 150 Series (WH)

Terminal Part Information

- Terminal/Tray: See Terminal Repair Kit
- Core/Insulation Crimp: See Terminal Repair Kit
- Release Tool/Test Probe: See Terminal Repair Kit

Traction Control Switch (AN3)

Pin	Wire Color	Circuit No.	Function
A	BN/WH	1571	Traction Control Switch Signal
B	BK	350	Ground

Wheel Speed Sensor (WSS) - LF

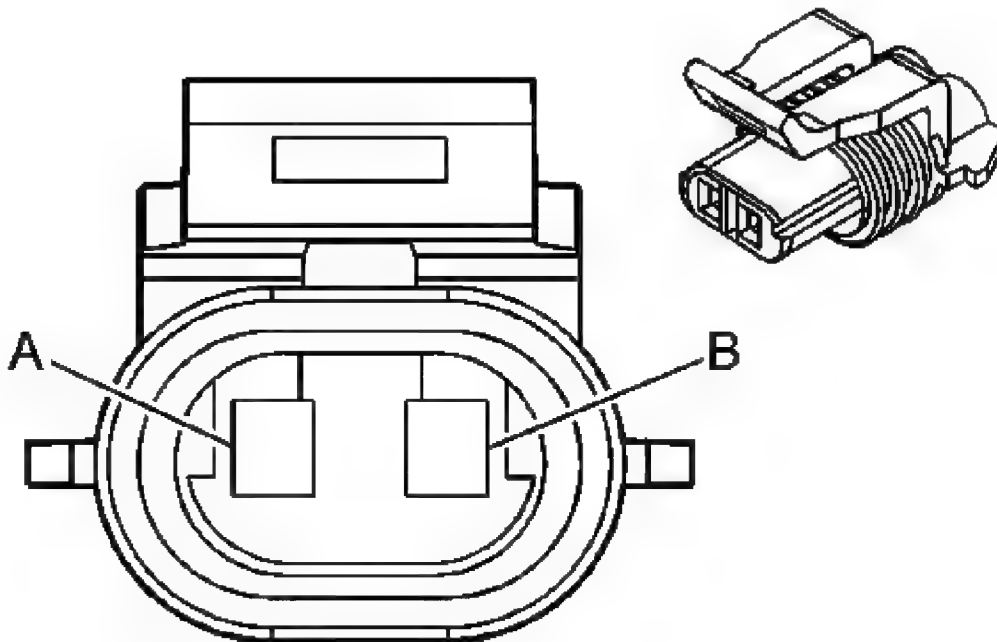


Fig. 14: Wheel Speed Sensor (WSS) Connector End View - LF
Courtesy of GENERAL MOTORS CORP.

Antilock Brake System Connector End Views

Connector Part Information

- OEM: 12052644

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- Service: See Catalog
- Description: 2-Way F Metri-Pack 150 Series, Sealed (GY)

Terminal Part Information

- Terminal/Tray: 12048074/2
- Core/Insulation Crimp: E/1
- Release Tool/Test Probe: 12094429/J-35616-2A (GY)

Wheel Speed Sensor (WSS) - LF

Pin	Wire Color	Circuit No.	Function
A	TN/YE	830	Left Front Wheel Speed Sensor Signal (Early Production)
	L-BU	830	Left Front Wheel Speed Sensor Signal (Late Production)
B	D-GN	873	Left Front Wheel Speed Sensor Low Reference (Early Production)
	YE	873	Left Front Wheel Speed Sensor Low Reference (Late Production)

Wheel Speed Sensor (WSS) - LR

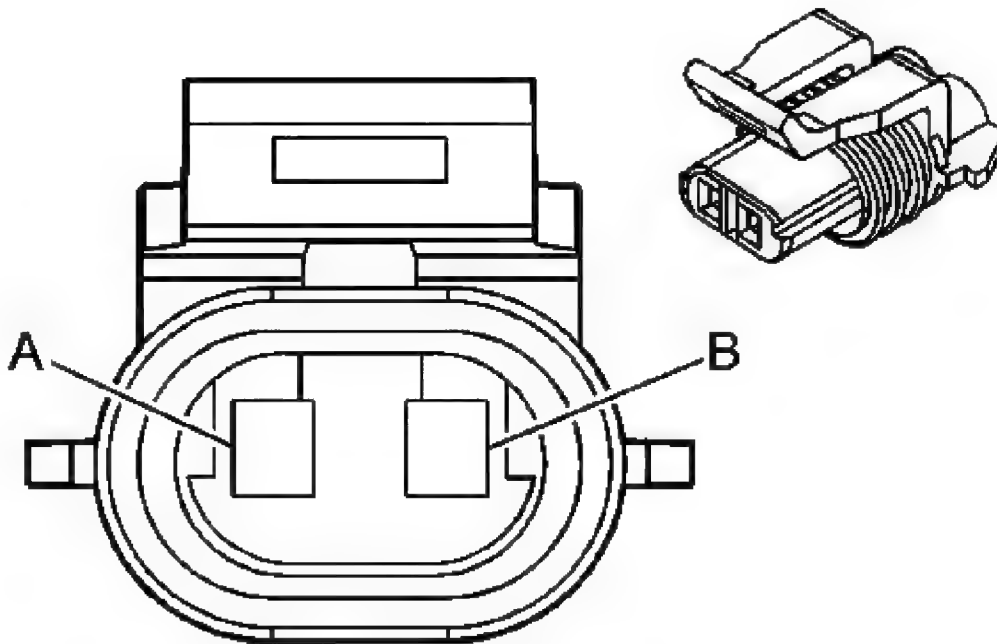


Fig. 15: Wheel Speed Sensor (WSS) Connector End View - LR
 Courtesy of GENERAL MOTORS CORP.

Antilock Brake System Connector End Views

Connector Part Information

- OEM: 12052644
- Service: See Catalog
- Description: 2-Way F Metri-Pack 150 Series, Sealed (GY)

Terminal Part Information

- Terminal/Tray: 12048074/2
- Core/Insulation Crimp: E/1
- Release Tool/Test Probe: 12094429/J-35616-2A (GY)

Wheel Speed Sensor (WSS) - LR

Pin	Wire Color	Circuit No.	Function
A	TN	884	Left Rear Wheel Speed Sensor Signal
B	OG	885	Left Rear Wheel Speed Sensor Low

Reference

Wheel Speed Sensor (WSS) - RF

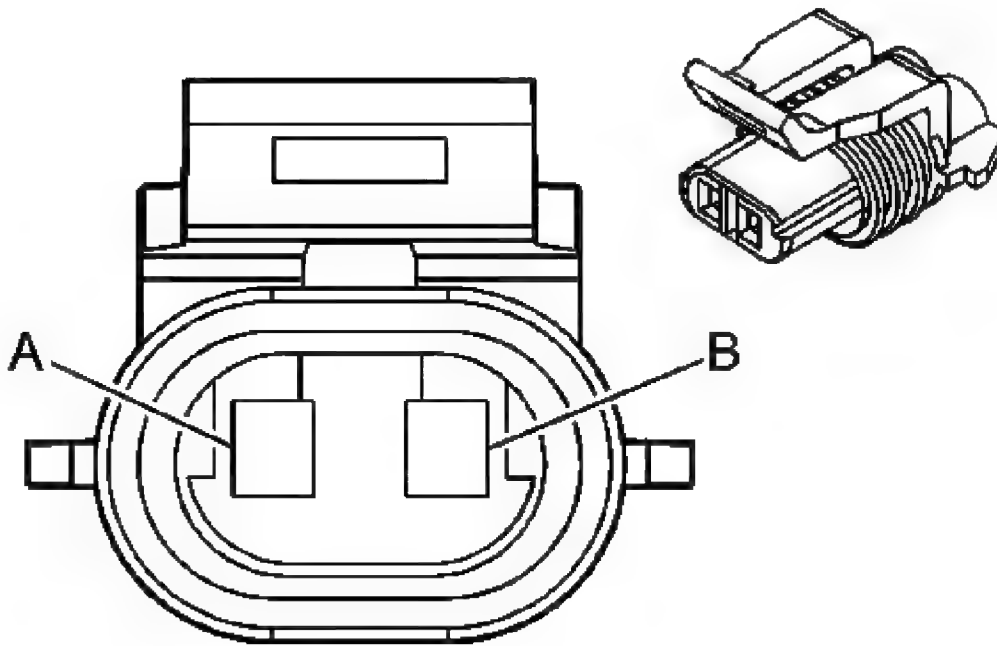


Fig. 16: Wheel Speed Sensor (WSS) Connector End View - RF
Courtesy of GENERAL MOTORS CORP.

Antilock Brake System Connector End Views

Connector Part Information

- OEM: 12052644
- Service: See Catalog
- Description: 2-Way F Metri-Pack 150 Series, Sealed (GY)

Terminal Part Information

- Terminal/Tray: 12048074/2
- Core/Insulation Crimp: E/1
- Release Tool/Test Probe: 12094429/J-35616-2A (GY)

Wheel Speed Sensor (WSS) - RF

Pin	Wire Color	Circuit No.	Function
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A	L-BU	872	Right Front Wheel Speed Sensor Signal (Early Production)
	D-GN	872	Right Front Wheel Speed Sensor Signal (Mid Production)
	D-GN/WH	872	Right Front Wheel Speed Sensor Signal (Late Production)
B	TN/YE	833	Right Front Wheel Speed Sensor Low Reference (Early Production)
	TN/WH	833	Right Front Wheel Speed Sensor Low Reference (Late Production)

Wheel Speed Sensor (WSS) - RR

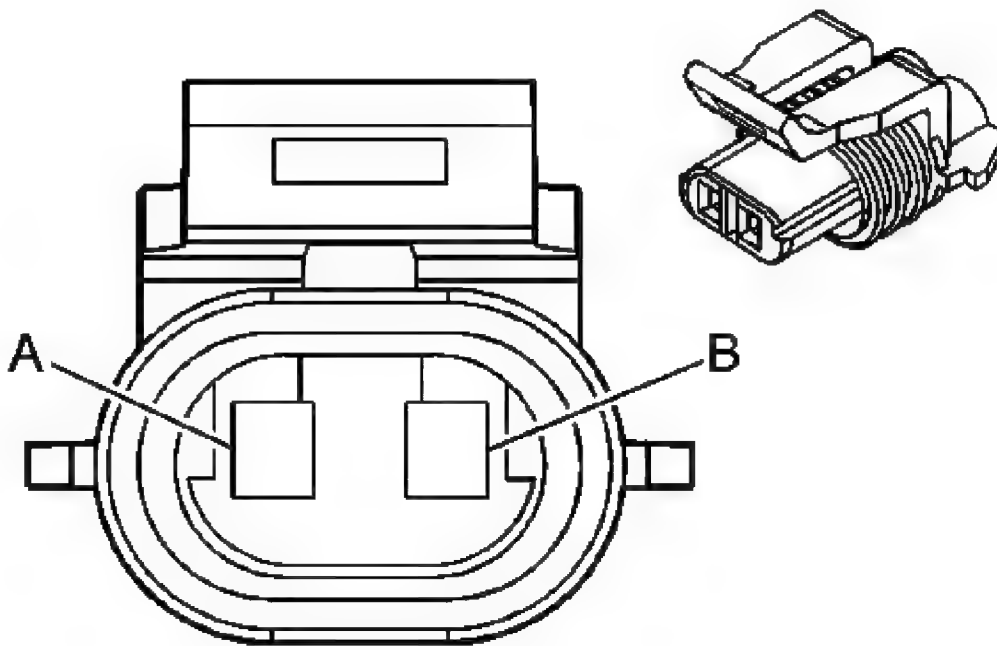


Fig. 17: Wheel Speed Sensor (WSS) Connector End View - RR
Courtesy of GENERAL MOTORS CORP.

Antilock Brake System Connector End Views

Connector Part Information

- OEM: 12052644
- Service: See Catalog

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- Description: 2-Way F Metri-Pack 150 Series, Sealed (GY)

Terminal Part Information

- Terminal/Tray: 12048074/2
- Core/Insulation Crimp: E/1
- Release Tool/Test Probe: 12094429/J-35616-2A (GY)

Wheel Speed Sensor (WSS) - RR

Pin	Wire Color	Circuit No.	Function
A	BN	882	Right Rear Wheel Speed Sensor Signal
B	WH	883	Right Rear Wheel Speed Sensor Low Reference

Yaw and Lateral Acceleration Sensor (JL4)

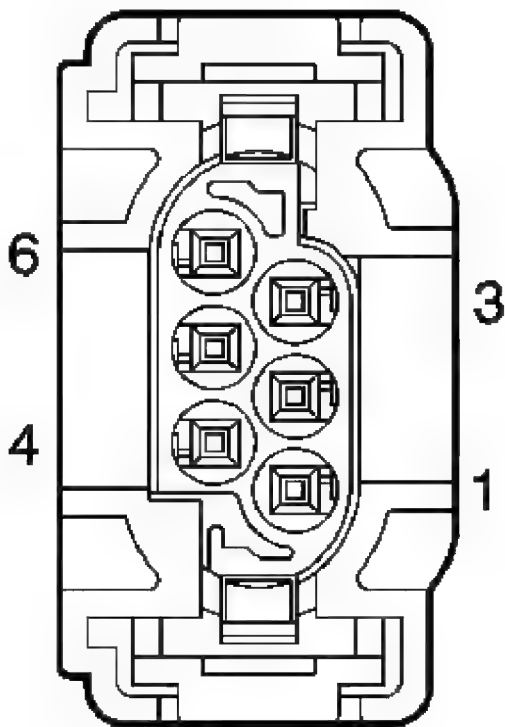


Fig. 18: Yaw & Lateral Acceleration Sensor (JL4) Connector End View
Courtesy of GENERAL MOTORS CORP.

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Antilock Brake System Connector End Views

Connector Part Information

- OEM: 2-967616-1
- Service: 88953345
- Description: 6-Way F Micro Series (GY)

Terminal Part Information

- Terminal/Tray: 962885-5/15
- Core/Insulation Crimp: 6/6
- Release Tool/Test Probe: 12094429/J-35616-64B (L-BU)

Yaw and Lateral Acceleration Sensor (JL4)

Pin	Wire Color	Circuit No.	Function
1	GY/BK	1337	5-Volt Reference
2	WH/BK	715	Lateral Accelerometer Signal
3	D-BU	716	Yaw Rate Sensor Signal
4	YE/BK	7033	Yaw Rate Diagnostic
5	D-BU	5370	Longitudinal Accelerometer Signal
6	PU	719	Low Reference

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC CODE INDEX

DIAGNOSTIC CODE INDEX

DTC	Description
<u>DTC C0035-C0050</u>	** MULTIPLE VALUES **
<u>DTC C0110</u>	**DESCRIPTION NOT COLLECTED **
<u>DTC C0131</u>	**DESCRIPTION NOT COLLECTED **
<u>DTC C0161</u>	**DESCRIPTION NOT COLLECTED **
<u>DTC C0179</u>	**DESCRIPTION NOT COLLECTED **
<u>DTC C0186</u>	**DESCRIPTION NOT COLLECTED **
<u>DTC C0196</u>	**DESCRIPTION NOT COLLECTED **
<u>DTC C0201</u>	**DESCRIPTION NOT COLLECTED **
<u>DTC C0242</u>	**DESCRIPTION NOT COLLECTED **
<u>DTC C0245</u>	**DESCRIPTION NOT COLLECTED **
<u>DTC C0292</u>	**DESCRIPTION NOT COLLECTED **
<u>DTC C0550</u>	**DESCRIPTION NOT COLLECTED **

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<u>DTC C0558</u>	**DESCRIPTION NOT COLLECTED **
<u>DTC C0561</u>	System Disabled Information Stored
<u>DTC C0710</u>	**DESCRIPTION NOT COLLECTED **
<u>DTC C0899</u>	**DESCRIPTION NOT COLLECTED **
<u>DTC C0900</u>	**DESCRIPTION NOT COLLECTED **

DIAGNOSTIC STARTING POINT - ANTILOCK BRAKE SYSTEM

Begin the system diagnosis with **Diagnostic System Check - Vehicle** . The Diagnostic System Check will provide the following information:

- The identification of the control modules which command the system
- The ability of the control modules to communicate through the serial data circuit
- The identification of any stored diagnostic trouble codes (DTCs) and their status

The use of the Diagnostic System Check will identify the correct procedure for diagnosing the system and where the procedure is located.

SCAN TOOL OUTPUT CONTROLS

Electronic Brake Control Module (EBCM)

Scan Tool Output Control	Additional Menu Selections	Description
ABS Relay	-	Commands the Antilock Brake System (ABS) relay ON and OFF.
Automated Bleed	-	Used in order to bleed the ABS hydraulics. Refer to <u>Antilock Brake System Automated Bleed Procedure</u> .
Automated Test	-	Cycles each solenoid valve and the pump motor in order to verify component operation. This test is identical to the Initialization Sequence. If a malfunction is detected, the electronic brake control module (EBCM) will set the appropriate DTCs. The DTCs will be displayed upon completion of the test.

SCAN TOOL DATA LIST

Electronic Brake Control Module (EBCM)

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Ignition ON, engine OFF and steering wheel straight			

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ABS Active	ABS Data	Yes/No	No
ABS Failed	ABS Data	Yes/No	No
Battery Voltage	ABS Data	Volts	12
BPP Signal	ABS Data	Released/Applied	Released
Brake Fluid Level Status	ABS Data	OK/Low	OK
Brake Pressure Sensor Input	VSES Data	Volts	0
Delivered Torque	TCS Data	%	-
DRP Active	ABS Data	Yes/No	No
DRP Disabled	ABS Data	Yes/No	No
Engine Drag Control Failed	ABS Data	Yes/No	No
Lateral Accelerometer Signal	VSES Data	Volts	2.5
LF Inlet Solenoid Command	ABS Data	ON/OFF	OFF
LF Outlet Solenoid Command	ABS Data	ON/OFF	OFF
LF Wheel Speed	<ul style="list-style-type: none"> • ABS Data • TCS Data • VSES Data 	km/h or mph	0
LR Inlet Solenoid Command	ABS Data	ON/OFF	OFF
LR Outlet Solenoid Command	ABS Data	ON/OFF	OFF
LR Wheel Speed	<ul style="list-style-type: none"> • ABS Data • TCS Data • VSES Data 	km/h or mph	0
Panic Brake Assist Failed	ABS Data	Yes/No	No
Pump Motor Commanded Voltage	<ul style="list-style-type: none"> • ABS Data • TCS Data 	Volts	12
Requested Torque	TCS Data	%	90
RF Inlet Solenoid Command	ABS Data	ON/OFF	OFF
RF Outlet Solenoid			

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Command	ABS Data	ON/OFF	OFF
RF Wheel Speed	<ul style="list-style-type: none"> • ABS Data • TCS Data • VSES Data 	km/h or mph	0
RR Inlet Solenoid Command	ABS Data	ON/OFF	OFF
RR Outlet Solenoid Command	ABS Data	ON/OFF	OFF
RR Wheel Speed	<ul style="list-style-type: none"> • ABS Data • TCS Data • VSES Data 	km/h or mph	0
SWPS Signal A	VSES Data	Volts	Varies 0-5
SWPS Signal B	VSES Data	Volts	Varies 0-5
TCS Active	ABS/TCS Data	Yes/No	No
TCS Failed	ABS/TCS Data	Yes/No	No
VSES Active	VSES Data	Yes/No	No
VSES Failed	VSES Data	Yes/No	No
Yaw Rate Sensor	VSES Data	Volts	2.5

Instrument Panel Cluster (IPC)

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Ignition ON, engine OFF			
Brake Fluid	Instrument Panel Data	OK/Low	OK
Brake Fluid Switch	Instrument Panel Data	Volts	12

Engine Control Module (ECM)

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Ignition ON, engine OFF			
BPP Signal	ECM Data	Released/Applied	Released
TCS Torque Request Signal	ECM Data	%	10
Torque Delivered Signal	ECM Data	%	90

SCAN TOOL DATA DEFINITIONS

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ABS Active

The scan tool displays Yes or No. Indicates if Antilock Brake System (ABS) is currently active.

ABS Failed

The scan tool displays Yes or No. Indicates if the electronic brake control module (EBCM) disabled ABS due to a malfunction.

Battery Voltage

The scan tool displays 0-30 volts. The voltage measured between the modules battery positive voltage circuit and ground circuit.

BPP Signal

The scan tool displays the applied state of the brake pedal position sensor.

Brake Fluid Level Status

The scan tool displays if level is OK or Low.

Brake Pressure Sensor Input

The scan tool displays 0-5 volts. Voltage signal indicates the master cylinder hydraulic pressure applied to the system

Delivered Torque

The scan tool displays 0-100%. The duty cycle of the signal is used to transmit how much engine torque the engine control module (ECM) is delivering. Normal values are between 10-90 percent duty cycle. The signal is at low values (approximately 10 percent) at idle and at higher values under driving conditions.

DRP Active

The scan tool displays Yes or No. The active status of the dynamic rear proportioning (DRP).

DRP Disabled

The scan tool displays Yes or No. Indicates if the EBCM disabled DRP due to a malfunction.

Engine Drag Control Failed

The scan tool displays Yes or No. Indicates if the EBCM disabled EDC due to a malfunction.

Lateral Accelerometer Signal

The scan tool displays 0-5 volts. The lateral accelerometer signal from the lateral accelerometer sensor, roughly 2.5 volts equals 0 g lateral acceleration.

LF Inlet Valve Command

The scan tool displays the commanded state of the left front inlet valve solenoid.

LF Outlet Valve Command

The scan tool displays the commanded state of the left front outlet valve solenoid.

LF Wheel Speed

The scan tool displays 0-255 km/h (0-159 mph). The actual speed of the left front wheel.

LR Inlet Valve Command

The scan tool displays the commanded state of the left rear inlet valve solenoid.

LR Outlet Valve Command

The scan tool displays the commanded state of the left rear outlet valve solenoid.

LR Wheel Speed

The scan tool displays 0-255 km/h (0-159 mph). The actual speed of the left rear wheel.

Panic Brake Assist Failed

The scan tool displays Yes or No. Indicates if the EBCM disabled Panic Brake Assist due to a malfunction.

Pump Motor Commanded Voltage

The scan tool displays the voltage applied to the ABS pump motor

Requested Torque

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The scan tool displays 0-100%. The duty cycle of the signal is used to transmit how much torque the EBCM is requesting the ECM to deliver. Normal values are between 10-90 percent duty cycle. The signal should be at 90 percent duty cycle when traction control is not active and at lower values (approximately 10 percent) when traction control is active.

RF Inlet Valve Command

The scan tool displays the commanded state of the left front inlet valve solenoid.

RF Outlet Valve Command

The scan tool displays the commanded state of the right front outlet valve solenoid.

RF Wheel Speed

The scan tool displays 0-255 km/h (0-159 mph). The actual speed of the right front wheel.

RR Inlet Valve Command

The scan tool displays the commanded state of the right rear inlet valve solenoid.

RR Outlet Valve Command

The scan tool displays the commanded state of the right rear outlet valve solenoid.

RR Wheel Speed

The scan tool displays 0-255 km/h (0-159 mph). The actual speed of the right rear wheel.

SWPS Signal 1

The scan tool displays 0-5 volts. The steering wheel position signal 1 input.

SWPS Signal 2

The scan tool displays 0-5 volts. The steering wheel position signal 2 input.

TCS Active

The scan tool displays Yes or No. Indicates if Traction Control System (TCS) is currently active.

TCS Failed

The scan tool displays if the EBCM is no longer able to perform traction control.

Torque Delivered Signal

The scan tool displays 0-100%. The duty cycle of the signal is used to transmit how much engine torque the ECM is delivering. Normal values are between 10-90 percent duty cycle. The signal is at low values (approximately 10 percent) at idle and at higher values under driving conditions.

Torque Request Signal

The scan tool displays 0-100%. The duty cycle of the signal is used to transmit how much torque the EBCM is requesting the ECM to deliver. Normal values are between 10-90 percent duty cycle. The signal should be at 90 percent duty cycle when traction control is not active and at lower values (approximately 10 percent) when traction control is active.

VSES Active

The scan tool displays Yes or No. Indicates if Vehicle Stability Enhancement System (VSES) is currently active.

VSES Failed

The scan tool displays Yes or No. Indicates if the EBCM disabled VSES due to a malfunction.

Yaw Rate Sensor

The scan tool displays 0-5 volts. The yaw rate signal from the yaw rate sensor, roughly 2.5 volts equals 0°/second yaw rate.

DIAGNOSTIC TEST DRIVE

When servicing vehicles with the vehicle stability enhancement system (VSES), test drives will be necessary to allow all tests to be run and all system functions to be enabled and exercised. A test drive may also be required to duplicate specific DTCs covered in this article. The diagnostic system check (including test drive) should be run when vehicle repairs are complete in order to verify the repair. The diagnostic test drive will vary for ABS, TCS or VSES concerns.

The following is a suggested VSES diagnostic test drive.

1. Read the Diagnostic Aids and the Conditions for Setting the DTC.

2. Turn OFF the ignition.
3. Reconnect any previously disconnected components.
4. Start the engine.
5. Install a scan tool.
6. With the scan tool, observe the VSES Is Centered parameter in the VSES data list. The scan tool will indicate Yes with the steering wheel centered. Drive the vehicle in a straight line for 45 seconds at 24 km/h (15 mph) while monitoring the scan tool.
7. Remove the scan tool.

IMPORTANT: Do not perform any unlawful or unsafe maneuvers.

8. Drive the vehicle under the following conditions for at least 10 minutes.
 - Highway driving
 - Rough roads
 - Perform turning maneuvers (curved freeway entrance ramp, parking lot maneuvers) and high steering angles and yaw rates at low speeds.
 - Verify the customers concern and duplicate driving conditions
9. With the engine still running, use the scan tool in order to check for DTCs. If any DTCs are set, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .

ENHANCED DIAGNOSTICS

History Data

Enhanced diagnostic information is found in the History Data function of the scan tool. Enhanced diagnostic information provides the service technician with specific malfunction occurrence information.

The scan tool will display the last 3 DTCs to occur, one at a time. The DTC with the most recent occurrence will be displayed first. Each DTC will include the following:

- The number of drive cycles since the DTC last occurred.
- The number of occurrences for the DTC since the scan tool DTC information was last cleared.

The most recent DTC will also display various data parameters with values from the time of the DTC occurrence.

Diagnostic Strategy

In difficult diagnostic situations use the above information to identify malfunction occurrence trends. Ask question such as the following:

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- Did the malfunction only occur once over a large number of drive cycles, indicating an unusual condition present when it occurred?
- Does the malfunction occur infrequently over a large number of drive cycles, indicating that special diagnostic techniques may be required to identify the source of the malfunction?

A malfunction that occurs more frequently increases the odds of finding the cause of the malfunction.

Use the information in order to determine if a DTC is intermittent. Use the information in order to determine if the DTC has not set for long periods of time due to weather changes or a repair prior to this visit.

DTC C0035-C0050

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC C0035 00

Left Front Wheel Speed Sensor Circuit No Additional Information

DTC C0035 0F

Left Front Wheel Speed Sensor Circuit Erratic Signal

DTC C0035 18

Left Front Wheel Speed Sensor Circuit Signal Amplitude Less Than Minimum

DTC C0040 00

Right Front Wheel Speed Sensor Circuit No Additional Information

DTC C0040 0F

Right Front Wheel Speed Sensor Circuit Erratic Signal

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DTC C0040 18

Right Front Wheel Speed Sensor Circuit Signal Amplitude Less Than Minimum

DTC C0045 00

Left Rear Wheel Speed Sensor Circuit No Additional Information

DTC C0045 0F

Left Rear Wheel Speed Sensor Circuit Erratic Signal

DTC C0045 18

Left Rear Wheel Speed Sensor Circuit Signal Amplitude Less Than Minimum

DTC C0050 00

Right Rear Wheel Speed Sensor Circuit No Additional Information

DTC C0050 0F

Right Rear Wheel Speed Sensor Circuit Erratic Signal

DTC C0050 18

Right Rear Wheel Speed Sensor Circuit Signal Amplitude Less Than Minimum

Diagnostic Fault Information**DTC C0035-C0050**

Circuit	Short to Ground	Open or High Resistance	Short to Voltage	Signal Performance
Left Front Sensor Signal	C0035 00	C0035 00	C0035 00	C0035 0F C0035 18
Left Front Sensor Low Reference	C0035 00	C0035 00	C0035 00	C0035 0F C0035 18
Right Front Sensor Signal	C0040 00	C0040 00	C0040 00	C0040 0F C0040 18
Right Front Sensor Low Reference	C0040 00	C0040 00	C0040 00	C0040 0F C0040 18
Left Rear Sensor Signal	C0045 00	C0045 00	C0045 00	C0045 0F ¹ C0045 18

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Left Rear Sensor Low Reference	C0045 00	C0045 00	C0045 00	C0045 0F ¹ C0045 18
Right Rear Sensor Signal	C0050 00	C0050 00	C0050 00	C0050 0F ¹ C0050 18
Right Rear Sensor Low Reference	C0050 00	C0050 00	C0050 00	C0050 0F ¹ C0050 18

¹ Damaged rear wheel speed sensor ring can cause code to set.

Circuit/System Description

As the wheel spins, the wheel speed sensor produces an AC signal. The electronic brake control module (EBCM) uses the frequency of the AC signal to calculate the wheel speed.

Conditions for Running the DTC

C0035 00-C0050 00

- The ignition is ON.
- Ignition voltage is greater than 8 volts.

C0035 0F-C0050 0F

- The ignition is ON.
- Ignition voltage is greater than 8 volts.
- The brake pedal is not pressed.
- A DTC is not set for the other wheel speed circuit on the same axle.

C0035 18-C0050 18

- The ignition is ON.
- Ignition voltage is greater than 8 volts.
- The brake pedal is not pressed.
- No other wheel speed circuit DTCs are set.
- At least 2 other wheel speeds are not 0 km/h.

Conditions for Setting the DTC

C0035 00-C0050 00

- An open is detected on the wheel speed sensor signal circuit.
- A short to ground is detected on the wheel speed sensor signal circuit.

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- A short to voltage is detected on the wheel speed sensor signal circuit.

C0035 0F-C0050 0F

The EBCM detects a rapid variation in the wheel speed. The wheel speed changes by 20 km/h (12 mph) or more in 0.01 second. The change must occur 3 times with no more than 0.2 second between occurrences.

C0035 18-C0050 18

- One wheel speed is 0 km/h.
- The remaining wheel speeds are greater than 8 km/h (5 mph).
- The difference between the remaining wheel speeds is less than 11 km/h (7 mph) from each other.

OR

- The 2 wheel speed sensor inputs are 0 and DTCs are set.
- The 2 suspect wheel speeds equal zero for 6 seconds.
- The other wheel speeds are greater than 16 km/h (10 mph).
- The other wheel speeds are within 11 km/h (7 mph) of each other.

Action Taken When the DTC Sets

- The EBCM disables the Antilock Brake System (ABS)/Traction Control System (TCS)/Vehicle Stability Enhancement System (VSES) for the duration of the ignition cycle.
- The dynamic rear proportion (DRP) does not function optimally.
- The ABS indicator turns ON.
- The traction control indicator turns ON.
- The driver information center (DIC) displays the Service Stability System message.

Conditions for Clearing the MIL/DTC

- The condition for setting the DTC is no longer present and the DTC is cleared with a scan tool.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

- A damaged rear wheel speed sensor ring can cause failure type byte 04 (Erratic Signal) to set.

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- If 2 or more wheel speed sensors are inoperative diagnose each wheel speed sensor individually.

C0035 18, 0F, 00-C0050 18, 0F, 00

If the customer comments that the ABS indicator is ON only during moist environmental conditions: rain, snow, vehicle wash, etc., inspect the wheel speed sensor wiring for signs of water intrusion. If the DTC is not current, clear all DTCs and simulate the effects of water intrusion by using the following procedure:

1. Spray the suspected area with a 5 percent saltwater solution. To create a 5 percent saltwater solution, add 2 teaspoons of salt to 8 fl oz of water (10 g of salt to 200 ml of water).
2. Test drive the vehicle over various road surfaces: bumps, turns, etc., above 40 km/h (25 mph) for at least 30 seconds.
3. Rinse the area thoroughly when completed.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Electrical Information Reference

- Circuit Testing
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs
- Connector Repairs

Scan Tool Reference

Scan Tool Data List for EBCM

Circuit/System Verification

With scan tool installed drive the vehicle in a straight line at a speed greater than 8 km/h (5 mph), all wheel speed sensors should read the same miles per hour.

Circuit/System Testing

IMPORTANT: It is recommend that Component Testing is performed before Circuit Testing when diagnosing wheel speed sensors.

1. With the ignition OFF, disconnect the EBCM connector.
2. With the ignition ON, measure for 0 volt between the sensor signal circuit or the low reference circuit and ground at the EBCM connector.
 - If over 0 volt, repair short to voltage in sensor signal circuit or the low reference circuit.
3. With the ignition OFF, Measure for infinite ohms of resistance between the wheel speed sensor signal or the low reference circuit and ground at the EBCM connector.
 - If less than infinite ohms, repair short to ground in the sensor signal or the low reference circuit.
4. Measure for 850-1350 ohms of resistance between the wheel speed sensor signal and low reference circuits at the EBCM connector.
 - If greater than 1350 ohms test for an open/high resistance in the circuit or faulty wheel speed sensor.
 - If less than 850 ohms test for a short between the circuits or faulty wheel speed sensor.
5. If all circuits test normal replace the EBCM.

Component Testing

1. Disconnect the wheel speed sensor connector.
2. With the ignition OFF, measure for 850-1350 ohms of resistance across the wheel speed sensor.
 - If the resistance is not between 850-1350 ohms replace the faulty wheel speed sensor.
3. Spin the wheel, measure across the wheel speed sensor for 100 mv AC or greater.
 - If the AC voltage is less than 100 mv replace the wheel speed sensor.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Front Wheel Bearing and Hub Replacement**
- **Rear Wheel Bearing and Hub Replacement**
- **Control Module References** for EBCM replacement, setup and programming

DTC C0110**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors**DTC C0110 04**

Pump Motor Circuit Open Circuit

DTC C0110 61

Pump Motor Circuit Actuator Stuck

Circuit/System Description

The electronic brake control module (EBCM) supplies ground to activate the Antilock Brake System (ABS) pump motor. An internal system relay in the EBCM supplies battery positive voltage to the pump motor when the ignition is turned ON. The EBCM monitors pump motor feedback voltage after activation to detect a stalled or binding pump motor.

Conditions for Running the DTC**C0110 04**

- System and ignition voltage is above 10.5 volts.
- The system enable relay is ON.
- The pump motor has been commanded OFF for 2.5 seconds.

C0110 61

- The ignition is ON.
- The system enable relay is ON.
- The pump motor has been commanded ON, OFF and ON again.

Conditions for Setting the DTC**C0110 04**

The EBCM detects an open in the pump motor circuit when the feedback voltage remains greater than 0.75 volt for more than 50 msec.

C00110 61

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The pump motor continues to rotate briefly after activation creating a feedback voltage. The EBCM sets the code if the measured feedback voltage indicates a binding or stalled pump motor.

Action Taken When the DTC Sets

- The EBCM disables the ABS/Traction Control System (TCS)/Vehicle Stability Enhancement System (VSES) for the duration of the ignition cycle.
- The ABS indicator turns ON.
- The Traction Control indicator turns ON.
- The driver information center (DIC) displays the Service Stability System message.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present and the DTC is cleared with a scan tool.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

The pump motor is integral to the brake pressure modulator valve (BPMV). The pump motor is not serviceable.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Scan Tool Data List

Circuit/System Testing

1. Ignition OFF, disconnect the EBCM harness connector and connect a test lamp between the battery positive voltage circuit terminal going to the ABS pump motor and to ground.
2. Ignition ON, verify that the test lamp illuminates.
 - If the test lamp does not illuminate, repair the open or high resistance in the battery positive voltage circuit.
3. Connect a test lamp between the battery positive voltage circuit and pump motor ground circuit at the EBCM connector, verify that the test lamp illuminates.
 - If the test lamp does not illuminate, repair the open or high resistance in the pump motor ground circuit.
4. Ignition OFF, remove the EBCM from the BPMV.
5. Inspect the EBCM to BPMV connector for conditions such as damage, corrosion or presence of brake fluid.
 - If connector corrosion or damage is evident, replace BPMV and/or EBCM as necessary.
 - If brake fluid is present, replace both BPMV and EBCM.
6. Connect the EBCM harness to the EBCM with the BPMV still separated.
7. Connect a test lamp between the pump motor circuits, internal EBCM side.
8. Ignition ON, use the scan tool to perform the Pump Motor Test.
 - If test lamp illuminates replace the BPMV.
 - If test lamp does not illuminate replace the EBCM.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Brake Pressure Modulator Valve Replacement**
- **Control Module References** for EBCM replacement, setup and programming

DTC C0131

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0131 00

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ABS Pressure Circuit No Additional Information

Circuit/System Description

The electronic brake control module (EBCM) uses input from the brake pressure sensor for more accurate control during a Vehicle Stability Enhancement System (VSES) event.

Conditions for Running the DTC

- The ignition is ON.
- Ignition voltage is greater than 8 volts.

Conditions for Setting the DTC

- Brake signal does not correlate to pressure signal.
- Signal is erratic and changes faster than physically allowed.

Action Taken When the DTC Sets

- The Traction Control indicator turns ON.
- The driver information center (DIC) displays the Service Stability System message.

Conditions for Clearing the DTC

- The condition for setting the DTC is no longer present and the DTC is cleared with a scan tool.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Reference Information

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Scan Tool Data List for EBCM

Circuit/System Testing

1. Apply and release brake pedal. Verify brake lamps operate properly.

- If brake lamps do not operate properly, refer to **Symptoms - Lighting Systems**.
2. Replace EBCM/brake pressure modulator valve (BPMV) assembly.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

DTC C0161**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor**DTC C0161 00****TCS Brake Switch Circuit****Circuit/System Description**

The brake pedal position (BPP) sensor is an input to the body control module (BCM). The BCM then sends a serial data message to the electronic brake control module (EBCM) and other electronic control modules. The BPP sensor is a potentiometer type sensor with a 5-volt reference circuit and a low reference circuit. The IPM supplies the 5-volt reference to the BPP.

Conditions for Running the DTC

- The ignition is ON.
- The vehicle speed is greater than 16 km/h (10 mph).
- The ignition voltage is greater than 8 volts.

Conditions for Setting the DTC

- The brake pedal is sensed as applied during moderate to high vehicle acceleration.
- With the vehicle decelerating, the brake pedal is sensed as released and the master cylinder pressure is greater than 90 psi.

Action Taken When the DTC Sets

- The EBCM disables the Traction Control System (TCS) and Vehicle Stability

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Enhancement System (VSES) for the duration of the ignition cycle.

- The Traction Control indicator turns ON.
- The driver information center (DIC) displays Service Stability System message.
- The Antilock Brake System (ABS) remains functional.

Conditions for Clearing the MIL/DTC

- The condition for the DTC is no longer present and the DTC is cleared with a scan tool.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

The DTC C0161 00 can be set if the vehicle has been driven with the brake applied during acceleration.

Reference Information

Scan Tool Reference

Scan Tool Data List for Electronic Brake Control Module (EBCM)

Circuit/System Verification

With the ignition ON, use a scan tool to display DTCs for the body control module (BCM).

- If DTC C0277 is present, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .
- If no DTCs are present, go to Diagnostic Aids.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

DTC C0179

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0179 00

System Thermal High

Circuit/System Description

The electronic brake control module (EBCM) monitors Traction Control System (TCS) activation in order to calculate an estimate of the EBCM solenoid valve temperatures. In most cases high solenoid valve temperatures are caused by extended TCS activation. If the EBCM calculates that the solenoid valve temperatures are too high, the EBCM will temporarily suspend the TCS function until the solenoid valves cool.

Conditions for Running the DTC

- The ignition is ON.
- Ignition voltage is greater than 8 volts.

Conditions for Setting the DTC

The estimated solenoid coil temperature reaches 220°C (428°F).

Action Taken When the DTC Sets

- The EBCM disables the TCS for the duration of the ignition cycle.
- The driver information center (DIC) displays the SERVICE TRACTION message.
- The DIC displays the Vehicle Stability Enhancement System (VSES) inhibited.

Conditions for Clearing the DTC

- After the solenoid valves have cooled the EBCM automatically re-enables TCS function.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

Most occurrences of this DTC are caused by excessive TCS activation or braking.

Reference Information

Antilock Brake System Schematics

Schematic Reference

Connector End View Reference

Antilock Brake System Connector End Views

Electrical Information Reference

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- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Scan Tool Data List for EBCM

Circuit/System Testing

IMPORTANT: Allow brakes to cool down before performing test.

1. With scan tool clear the DTC.
2. With scan tool connected test drive the vehicle under normal braking conditions and without causing TC or ABS activation. Verify DTC C0179 resets.
 - o If the DTC resets replace the EBCM.
3. Refer to **Diagnostic Aids**

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

DTC C0186

DTC Descriptor

DTC C0186

Lateral Accelerometer Circuit

Diagnostic Fault Information

Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.

DTC C0186

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 Volt Reference	C0292 00	C0292 00	C0292 00	-
Yaw Rate Sensor Signal	C0196 00	C0196 00	C0196 00	-
Lateral Accelerometer Signal	C0186 00	C0186 00	C0186 00	-
Low Reference	C0186 00	C0186 00	C0186 00	C0196 28

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	C0196 00	C0196 00	C0196 00	
Yaw Rate Frequency Signal	C0196 28	C0196 28	C0196 28	-
Longitudinal Accelerometer Sensor Signal	-	-	-	-

Circuit/System Description

The lateral accelerometer and the yaw rate sensors are combined into one sensor external to the electronic brake control module (EBCM). The vehicle stability enhancement system (VSES) uses the lateral accelerometer input when calculating the desired yaw rate. The usable output voltage range for the lateral accelerometer is 0.25-4.75 volts.

Conditions for Running the DTC

The ignition is ON.

Conditions for Setting the DTC

- Lateral acceleration does not change when reducing speed from 30 km/h to 0 km/h and the condition occurs 16 times in a row.
- The yaw/lateral combination sensor fails an internal self test.
- Ignition voltage to the yaw/lateral combination sensor is less than 9.5 volts.
- Communication is lost between the EBCM and the yaw/lateral combination sensor.

Action Taken When the DTC Sets

- The EBCM turns OFF the 5 volt reference circuit, until the ignition is cycled.
- The driver information center (DIC) displays the Service Stabilitrak message.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present and the DTC is cleared with a scan tool.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

- If DTC C0292 is set, diagnose that DTC first.
- If the yaw and lateral accelerometer sensor is disconnected, DTCs will set and the EBCM will not provide 5 volt reference.
- The yaw rate and lateral accelerometer sensors are located in one unit and cannot be serviced separately.
- A poor ground connection for the EBCM may cause this DTC to set.

Reference Information**Schematic Reference****Antilock Brake System Schematics****Connector End View Reference****Antilock Brake System Connector End Views****Electrical Information Reference**

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference**Scan Tool Data List for EBCM****Circuit/System Testing**

1. Ignition OFF, disconnect the yaw rate sensor/lateral accelerometer connector.
2. Ignition OFF, test for less than 1 ohm of resistance between the low reference circuit and ground.
 - If greater than 1 ohm, test the low reference circuit and the EBCM ground circuit for a short to voltage or an open/high resistance. If the circuits test normal, replace the EBCM.
3. Test the lateral accelerometer signal circuit, the 5 volt reference circuit and the low reference circuit for an open/high resistance or a short to voltage or ground.
 - If all circuits test normal, replace the yaw rate sensor/lateral accelerometer and clear the yaw rate sensor offset value in the EBCM.
 - If the DTC sets again after replacing the yaw rate sensor/lateral accelerometer, replace the EBCM.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Vehicle Yaw Sensor with Vehicle Lateral Accelerometer Replacement**
- **Control Module References** for EBCM replacement, setup and programming

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DTC Descriptors

DTC C0196 00

Yaw Rate Circuit No Additional Information

DTC C0196 28

Yaw Rate Circuit Incorrect Frequency

Diagnostic Fault Information

Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.

DTC C0196

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 Volt Reference	C0292 00	C0292 00	C0292 00	-
Yaw Rate Sensor Signal	C0196 00	C0196 00	C0196 00	-
Lateral Accelerometer Signal	C0186 00	C0186 00	C0186 00	-
Low Reference	C0186 00 C0196 00	C0186 00 C0196 00	C0186 00 C0196 00	-
Yaw Rate Frequency Signal	C0196 28	C0196 28	C0196 28	C0196 28
Longitudinal Accelerometer Sensor Signal	-	-	-	-

Circuit/System Description

The vehicle stability enhancement system (VSES) is activated by the electronic brake control module (EBCM) calculating the desired yaw rate and comparing it to the actual yaw rate input. The desired yaw rate is calculated from measured steering wheel position, vehicle speed and lateral acceleration. The difference between the desired yaw rate and actual yaw rate is the yaw rate error, which is a measurement of oversteer or understeer. If the yaw rate error becomes too large, the EBCM will attempt to correct the vehicle's yaw motion by applying differential braking to the wheels.

Conditions for Running the DTC

- The ignition is ON.
- Ignition voltage is greater than 8 volts.

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Conditions for Setting the DTC

C0196 00

- The vehicle speed has reached at least 15 km/h (9 mph) from a stop more three times during the same ignition cycle. During the time the vehicle is stationary, the yaw rate signal value is more than 7 deg/sec for 2 seconds.
- When vehicle speed is more than 25 km/h (16 mph) in a turn the difference between the yaw rate, steering angle, lateral acceleration and wheel speed sensor values are not correlated three consecutive times.
- Yaw rate changes greater than 20 deg/sec in 6 ms four times in one second.
- The yaw/lateral combination sensor fails an internal self test.

C0196 28

The yaw frequency measured is not between 13400.0-14600.0 Hz for more than 200 msec.

Action Taken When the DTC Sets

- The EBCM turns OFF the 5 volt reference circuit, until the ignition is cycled.
- The driver information center (DIC) displays the Service Stabilitrak message.

Conditions for Clearing the DTC

- The condition for setting the DTC is no longer present and the DTC is cleared with a scan tool.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

- If DTC C0292 is set, diagnose that DTC first.
- If the yaw and lateral accelerometer sensor is disconnected, DTCs will set and the EBCM will not provide 5 volt reference.
- The yaw rate and lateral accelerometer sensors are located in one unit and cannot be serviced separately.
- A poor ground connection for the EBCM may cause this DTC to set.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Scan Tool Data List

Circuit/System Testing

C0196 00

1. Ignition OFF, disconnect the yaw rate sensor/lateral accelerometer connector.
2. Ignition OFF, test for less than 1 ohm of resistance between the low reference circuit and ground.
 - If greater than 1 ohm, test the low reference circuit and the EBCM ground circuit for a short to voltage or an open/high resistance. If the circuits test normal, replace the EBCM.
3. Test the lateral accelerometer signal circuit, the 5 volt reference circuit and the low reference circuit for an open/high resistance or a short to voltage or ground.
 - If all circuits test normal, replace the yaw rate sensor/lateral accelerometer and clear the yaw rate sensor offset value in the EBCM.
 - If the DTC sets again after replacing the yaw rate sensor/lateral accelerometer, replace the EBCM.

C0196 28

1. Ignition OFF, disconnect the yaw rate sensor/lateral accelerometer connector and EBCM connector.
2. Test for infinite resistance between the yaw rate frequency circuit and ground.
 - If less than infinite resistance, test the yaw rate frequency circuit for a short to ground.
3. Test for less than 1 ohm of resistance on the yaw rate frequency circuit between the yaw rate sensor/lateral accelerometer connector and EBCM connector.
 - If greater than 1 ohm, test the yaw rate frequency circuit for an open/high resistance.
4. Replace yaw rate sensor/lateral accelerometer and clear the yaw rate sensor offset value

in the EBCM. If C0196 28 is still current, replace the EBCM.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Vehicle Yaw Sensor with Vehicle Lateral Accelerometer Replacement**
- **Control Module References** for EBCM replacement, setup and programming

DTC C0201

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0201

Antilock Brake System (ABS) Enable Relay Contact Circuit

Circuit/System Description

The solenoid relay, located within the electronic brake control module (EBCM), supplies battery voltage to all of the valve solenoids.

Conditions for Running the DTC

- Ignition voltage is greater than 9.5 volts.
- The solenoid relay is commanded ON.

Conditions for Setting the DTC

- The EBCM detects an open in the battery positive voltage circuit to the solenoid valve relay.
- The EBCM detects a stuck open solenoid valve relay or an open circuit between the solenoid valve relay and solenoid valves.

Action Taken When the DTC Sets

- The EBCM disables the Antilock Brake System (ABS)/Traction Control System (TCS)/dynamic rear proportion (DRP)/Vehicle Stability Enhancement System (VSES) for the duration of the ignition cycle.

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- The ABS indicator turns ON.
- The Traction Control indicator turns ON.
- The driver information center (DIC) displays the SERVICE ABS/TRACTION message.
- The DIC displays the PANIC BRAKE ASSIST message.

Conditions for Clearing the DTC

- The condition for setting the DTC is no longer present and the DTC is cleared with a scan tool.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Scan Tool Data List

Circuit/System Verification

With the scan tool, access the ABS special functions menu and perform the ABS Motor test. The pump motor should function and no DTCs should be set.

Circuit/System Testing

1. Test for an open or a short to ground in the solenoid valve battery positive voltage circuit. Verify no open or a short to ground is found.
 - If open or a short to ground is found repair circuit.
2. Replace the EBCM/brake pressure modulator valve (BPMV) assembly.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References for EBCM replacement, setup and programming

DTC C0242**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor**DTC C0242 00, 71, 75**

Engine Control Module (ECM) Indicated TCS Malfunction

Circuit/System Description

The electronic brake control module (EBCM) and the engine control module (ECM) simultaneously control the traction control. The EBCM sends a serial data message to the ECM requesting torque reduction. When certain ECM DTCs are set, the ECM will not be able to perform the torque reduction for traction control. A serial data message is sent to the EBCM indicating that traction control is not allowed.

Conditions for Running the DTC

- The ignition is ON.
- Ignition voltage is greater than 8 volts.

Conditions for Setting the DTC

The ECM diagnoses a condition preventing the engine control portion of the traction control function and sends a serial data message to the EBCM indicating that torque reduction is not allowed. The ECM will typically set a DTC and the EBCM will set this DTC.

Actions Taken When DTC Sets

- The EBCM disables the TCS for the duration of the ignition cycle.
- The Traction Off indicator turns ON.
- The message center displays the Service Traction System message.

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- The ABS remains functional.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present and the DTC is cleared with a scan tool.
- The electronic brake control module (EBCM) automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

This DTC is for information only. As an aid to the technician, this DTC indicates that there are no problems in the ABS/TCS system.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Description and Operation

ABS Description and Operation

Electrical Information Reference

- Testing for Intermittent Conditions and Poor Connections
- Circuit Testing

Scan Tool Reference

- Scan Tool Data Definitions
- Scan Tool Output Controls

Circuit/System Verification

Verify that there are no DTCs set in the ECM.

- If there are any DTCs set in the ECM, diagnose those DTCs.

Repair Procedures

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

Control Module References

DTC C0245

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0245

Wheel Speed Sensor Frequency Error

Circuit/System Description

As the wheel spins, the wheel speed sensor produces an AC signal. The electronic brake control module (EBCM) uses the frequency of the AC signal to calculate the wheel speed.

Conditions for Running the DTC

- The ignition is ON.
- Ignition voltage is greater than 8 volts.
- Vehicle must be moving at a speed less than 14.5 km/h (9 mph).
- No wheel speed sensor faults exist.
- Brake is not applied.
- Vehicle is not cornering.
- No wheel spinning is detected.

Conditions for Setting the DTC

Wheel speed differences between one wheel and the others is greater than 25 percent.

Action Taken When the DTC Sets

- Antilock Brake System (ABS), Traction Control System (TCS) and Vehicle Stability Enhancement System (VSES) are inhibited.
- The ABS indicator turns ON.

Conditions for Clearing the MIL/DTC

- The condition for the DTC is no longer present.

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- The condition for the DTC is no longer present and the DTC is cleared with a scan tool.

Diagnostic Aids

- Faulty wheel speed sensor will not set this DTC.
- A vehicle using a space saver spare will not set this code.

Circuit/System Verification

Inspect for one tire that has improper air pressure or improper size.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

DTC C0292

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0292

VSES Combination Sensor Circuits

Circuit/System Description

The electronic brake control module (EBCM) supplies a reference voltage of 5 volts to the yaw rate sensor/lateral accelerometer and the steering wheel position sensor. The sensor supply voltage is monitored via an internal feedback circuit to the EBCM microprocessor.

Conditions for Running the DTC

- The ignition is ON.
- Ignition voltage is greater than 8 volts.

Conditions for Setting the DTC

The EBCM detects that the sensor supply voltage is less than 4.75 volts or greater than 5.25 volts for 30 milliseconds.

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Action Taken When the DTC Sets

- The EBCM turns OFF the 5 volt reference circuit, until the ignition is cycled.
- The EBCM disables the traction control system (TCS)/vehicle stability enhancement system (VSES) for the duration of the ignition cycle.
- The antilock brake system (ABS) indicator turns on.
- The vehicle dynamics caution (VDC) indicator turns on.
- The driver information center (DIC) displays the SERVICE STABILITRAK message.

Conditions for Clearing the DTC

- The condition for setting the DTC is no longer present and the DTC is cleared with a scan tool.
- The ABS indicator may remain illuminated after repairs are made and DTCs are cleared, until the vehicle is operated at speeds greater than 13 km/h (8 mph) and the self test is completed.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

If the yaw and lateral accelerometer sensor is disconnected, DTCs will set and the EBCM will not provide 5 volt reference.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Scan Tool Data List for EBCM

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Circuit/System Testing

1. Ignition OFF, disconnect the yaw rate sensor/lateral accelerometer connector.
2. Ignition OFF, test for less than 1 ohm of resistance between the low reference circuit and ground.
 - If greater than 1 ohm, test the low reference circuit and the EBCM ground circuit for a short to voltage or an open/high resistance. If the circuits test normal, replace the EBCM.
3. Test the lateral accelerometer signal circuit, the 5 volt reference circuit and the low reference circuit for an open/high resistance or a short to voltage or ground.
 - If all circuits test normal, replace the yaw rate sensor/lateral accelerometer and clear the yaw rate sensor offset value in the EBCM.
 - If the DTC sets again after replacing the yaw rate sensor/lateral accelerometer, replace the EBCM.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References for EBCM replacement, setup and programming

DTC C0550

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0550

Electronic Control Unit (ECU) Performance

Circuit/System Description

The electronic brake control module (EBCM) detects an internal malfunction.

Conditions for Running the DTC

The ignition switch is in the ON position.

Conditions for Setting the DTC

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An internal EBCM malfunction exists.

Action Taken When the DTC Sets

One or more of the following actions may occur:

- The Antilock Brake System (ABS)/adaptive cruise control (ACC)/dynamic rear proportion (DRP)/engine drag control (EDC)/Vehicle Stability Enhancement System (VSES) are disabled.
- TCS is degraded.
- The ABS/TCS indicators turn ON.
- The red BRAKE Warning indicator turns ON.

Conditions for Clearing the MIL/DTC

- The condition for the DTC is no longer present and the DTC is cleared with a scan tool.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Circuit/System Verification

DTC C0550 will set as result of internal EBCM circuit failure.

- Replace the EBCM.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References - Electronic Brake Control Module

DTC C0558

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0558

Calibration Data Not Programmed/Learned

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Circuit/System Description

The electronic brake control module (EBCM) must be calibrated.

Conditions for Running the DTC

- The ignition is ON.
- Ignition voltage is greater than 8 volts.

Conditions for Setting the DTC

The EBCM has not been calibrated.

Actions Taken When DTC Sets

- The EBCM disables the ABS and the TCS for the duration of the ignition cycle.
- The ABS indicator turns ON.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present and the DTC is cleared with a scan tool.
- The electronic brake control module (EBCM) automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference

Antilock Brake System Connector End Views

Description and Operation

ABS Description and Operation

Electrical Information Reference

- **Testing for Intermittent Conditions and Poor Connections**
- **Circuit Testing**

Scan Tool Reference

- **Scan Tool Data Definitions**
- **Scan Tool Output Controls**

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Circuit/System Verification

Calibrate the EBCM.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References for EBCM calibration

DTC C0561

Circuit Description

The electronic brake control module (EBCM) disables the traction control when other electronic control modules set DTCs for components that effect the operation of the traction control system.

DTC Descriptor

This diagnostic procedure supports the following DTC:

DTC C0561 System Disabled Information Stored

This vehicle has DTCs which include DTC Symptoms. For more information on DTC Symptoms, refer to **DTC Symptom Description** .

DTC C0561

DTC Symptom	DTC Symptom Descriptor
71	Invalid Serial Data Received

Diagnostic Fault Information

Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.

Conditions for Running the DTC

- The ignition is ON.
- Ignition voltage is greater than 8 volts.

Conditions for Setting the DTC

The PCM or BCM diagnoses a condition preventing the engine control portion of the traction control function and sends a serial data message to the EBCM indicating that torque reduction is not allowed. The PCM or BCM will typically set a DTC and the EBCM will set this DTC.

Action Taken When the DTC Sets

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- The EBCM disables the TCS until the DTC becomes a history DTC.
- The Traction Off indicator turns ON.
- The ABS remains functional.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present and the DTC is cleared with a scan tool.
- The electronic brake control module (EBCM) automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

This DTC is for information only. As an aid to the technician, this DTC indicates that there are no problems in the ABS/TCS system.

DTC C0710

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0710 00

Steering Position Signal No Additional Information

Diagnostic Fault Information

DTC C0710

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Steering Wheel Position Sensor 5 Volt Reference Voltage	C0292	C0292	C0292	-
Low Reference	C0710 00	C0710 00	-	-
Steering Wheel Position Signal A	C0710 00	C0710 00	-	-
Steering Wheel Position Signal B	C0710 00	C0710 00	-	-

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Circuit/System Description

The steering wheel position sensor supplies 2 analog inputs, Phase A and Phase B, to the electronic brake control module (EBCM). The 2 input signals are approximately 90 degrees out of phase. By interpreting the relationship between the 2 inputs, the EBCM can determine the position of the steering wheel and the direction of the steering wheel rotation.

Conditions for Running the DTC

- The ignition is ON.
- Ignition voltage is greater than 8 volts.

Conditions for Setting the DTC

- Phase A and Phase B signal resistance values do not correlate to one another.
- The calculated steering angle from the steering wheel position sensor does not correlate with the steering angle calculated from the yaw rate.

Action Taken When the DTC Sets

- The EBCM turns OFF the 5 volt reference circuit, until the ignition is cycled.
- The EBCM disables the vehicle stability enhancement system (VSES) for the duration of the ignition cycle.
- The driver information center (DIC) displays the SERVICE STABILITRAK message.
- The antilock brake system (ABS) remains functional.
- The vehicle dynamics caution (VDC) indicator turns ON.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present and the DTC is cleared with a scan tool.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

- If DTC C0292 is set, diagnose that DTC first.
- If the steering wheel position sensor is disconnected, DTCs will set and the EBCM will not provide 5-volt reference.
- A poor ground connection for the EBCM may cause this DTC to set.

Reference Information

Schematic Reference

Antilock Brake System Schematics

Connector End View Reference**Antilock Brake System Connector End Views****Electrical Information Reference**

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference**Scan Tool Data List for EBCM****Circuit/System Verification**

1. Position the steering wheel to the straight-ahead, centered, position.
2. Install a scan tool, ignition ON, engine OFF. View the SWPS Signal A and SWPS Signal B parameters in the VSES Data display. One of the signals should be approximately 2.5 volts and the other should be approximately 0 volt.
3. As the steering wheel is turned, each signal should travel smoothly between 0 and 5 volts.

Circuit/System Testing

1. Ignition OFF, disconnect the steering wheel position sensor (SWPS) connector.
2. Ignition OFF, test for less than 1 ohm of resistance between the low reference circuit and ground.
 - If greater than 1 ohm, test the low reference circuit and the EBCM ground circuit for a short to voltage or an open/high resistance. If the circuits test normal, replace the EBCM.
3. Test the signal A circuit, signal B circuit, 5 volt reference circuit and the low reference circuit for an open/high resistance or a short to voltage or ground.
 - If all circuits test normal, replace the SWPS.
 - If the DTC sets again after replacing the SWPS, replace the EBCM.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Steering Wheel Position Sensor Replacement**
- **Control Module References** for EBCM replacement, setup and programming

DTC C0899**Diagnostic Instructions**

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DTC Descriptor**DTC C0899**

Device Voltage Low

Circuit/System Description

The electronic brake control module (EBCM) monitors the ignition voltage level available for system operation. A low voltage condition prevents the system from operating properly.

Conditions for Running the DTC

Ignition is ON.

Conditions for Setting the DTC

This fault will be set if the ignition voltage to EBCM is less than 9 volts for 100 msec.

Action Taken When the DTC Sets

- Traction Control System (TCS) and Vehicle Stability Enhancement System (VSES) for the duration of the ignition cycle.
- The TC indicator turns ON.
- The driver information center (DIC) displays the Service Stability System message.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present and the DTC is cleared with a scan tool.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Circuit/System Testing

1. Measure the voltage at the battery terminals.
2. With scan tool read the ignition voltage in the EBCM data list. Verify that battery terminal voltage and ignition voltage readings do not differ more than 1 volt.

- If more than 1 volt test the ground circuit of the EBCM for high resistance or replace the EBCM.

3. Go to **Charging System Test** .

DTC C0900

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC C0900

Device Voltage High

Circuit/System Description

The electronic brake control module (EBCM) monitors the ignition voltage. If the voltage level is too high, damage may result in the system. When a high voltage condition is detected the EBCM turns OFF the system relay which removes battery voltage from the solenoid valves and pump motor.

Conditions for Running the DTC

Ignition is ON.

Conditions for Setting the DTC

The system voltage is greater than 16 volts for 100 msec.

Action Taken When the DTC Sets

- Traction Control System (TCS) and Vehicle Stability Enhancement System (VSES) disabled for the duration of the ignition cycle.
- Antilock Brake System (ABS) disabled if ignition voltage exceeds 19.5 volts.
- The TC indicator turns ON.
- The ABS indicator turns ON if voltage exceeds 19.5 volts.
- The driver information center (DIC) displays the Service Stability System message.

Conditions for Clearing the DTC

- The condition for the DTC is no longer present and the DTC is cleared with a scan tool.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Diagnostic Aids

Test the charging system. Refer to **Charging System Test** .

SYMPTOMS - ANTILOCK BRAKE SYSTEM

IMPORTANT: The following steps must be completed before using the symptom tables.

1. Perform the **Diagnostic System Check - Vehicle** before using the Symptom Tables in order to verify that all of the following are true:
 - There are no DTCs set.
 - The control modules can communicate via the serial data link.
2. Review the system operation in order to familiarize yourself with the system functions. Refer to **ABS Description and Operation**.

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the antilock brake system. Refer to **Checking Aftermarket Accessories** .
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.
- Inspect the master cylinder reservoir for the proper brake fluid level.

Intermittent

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to **Testing for Intermittent Conditions and Poor Connections** .

Symptom List

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- **ABS Indicator Always On**
- **ABS Indicator Inoperative**
- **Traction Off Indicator Always On**
- **Traction Off Indicator Inoperative**

- **Vehicle Stability Enhancement System Poor Performance**

ABS INDICATOR ALWAYS ON**Diagnostic Fault Information**

Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.

Circuit/System Description

The instrument panel cluster (IPC) illuminates the Antilock Brake System (ABS) indicator by supplying ground to the lamp. The electronic brake control module (EBCM) sends a serial data messages to the IPC, in order to command the indicator ON or OFF.

Reference Information**Schematic Reference****Antilock Brake System Schematics****Connector End View Reference**

- **Antilock Brake System Connector End Views**
- **Instrument Panel, Gages and Console Connector End Views**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference**Scan Tool Data List for EBCM****Circuit/System Testing**

Note: Diagnose all vehicle DTCs before using this diagnostic.

With the scan tool, select instrument panel special functions Lamp Test. Command the instrument panel warning lamps OFF.

- If the ABS warning lamp does not turn OFF, replace the IPC.
- If the ABS lamp turns OFF and there are no DTCs stored in any vehicle systems, replace the EBCM.

Repair Procedures

IMPORTANT: Always perform the Diagnostic Repair Verification after completing the diagnostic procedure.

Control Module References for EBCM or IPC replacement, setup and programming

ABS INDICATOR INOPERATIVE**Diagnostic Fault Information**

IMPORTANT: Always perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.

Circuit/System Description

The instrument panel cluster (IPC) illuminates the Antilock Brake System (ABS) indicator by supplying ground to the lamp. The electronic brake control module (EBCM) sends a serial data messages to the IPC, in order to command the indicator ON or OFF.

Reference Information**Schematic Reference****Antilock Brake System Schematics****Connector End View Reference**

- **Antilock Brake System Connector End Views**
- **Instrument Panel, Gages and Console Connector End Views**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference**Scan Tool Data List** for EBCM**Circuit/System Testing**

1. With the scan tool, select instrument panel special functions Lamp Test. Command the instrument panel lamps ON. Verify ABS lamp illuminates.

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- If the ABS lamp does not illuminate, replace the IPC.
- 2. Replace the EBCM.

Repair Procedures

IMPORTANT: Always perform the Diagnostic Repair Verification after completing the diagnostic procedure.

Control Module References for EBCM and IPC replacement, setup and programming

TRACTION OFF INDICATOR ALWAYS ON

Diagnostic Fault Information

IMPORTANT: Always perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.

Circuit/System Description

The electronic brake control module (EBCM) sends a serial data message to the instrument panel cluster (IPC) to illuminate the Traction Control indicator when the EBCM has disabled Traction Control System (TCS) due to a DTC. The Traction Control indicator will also turn ON during the instrument cluster bulb check. When the ignition switch is turned to ON, the Traction Control indicator will turn ON for approximately 3 seconds and then turn OFF.

Reference Information

Schematic Reference

- Antilock Brake System Schematics
- Instrument Panel, Gages and Console Connector End Views

Connector End View Reference

Antilock Brake System Connector End Views

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Scan Tool Data List for EBCM**Circuit/System Testing**

Note: Diagnose all vehicle DTCs before using this diagnostic.

With the scan tool, select instrument panel special functions Lamp Test. Command the instrument panel lamps OFF. Verify TC lamp turns OFF.

- If the TC warning lamp does not turn OFF, replace the IPC.

Repair Procedures

IMPORTANT: Always perform the Diagnostic Repair Verification after completing the diagnostic procedure.

Control Module References for EBCM or IPC replacement, setup and programming

TRACTION OFF INDICATOR INOPERATIVE**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

When the body control module (BCM) sees the traction control switch input grounded through the momentary traction control switch, it sends a serial data message to the electronic brake control module (EBCM) that tells the EBCM that the traction control switch has been pressed. The EBCM then disables traction control and sends a serial data message to the instrument cluster to turn ON the Traction Off indicator on the instrument panel. Each time the ignition is cycled from OFF to ON, the traction control system is enabled.

Reference Information**Schematic Reference****Antilock Brake System Schematics****Connector End View Reference****Antilock Brake System Connector End Views**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference**Scan Tool Data List****Circuit/System Testing**

1. With the scan tool, select instrument panel special functions Lamp Test. Command the instrument panel lamps ON. Verify traction off lamp turns ON.
 - If the traction off lamp does not turn ON, replace the instrument panel cluster (IPC).
2. Ignition OFF, disconnect traction control switch connector. Ignition ON, measure for 10-13 volts between traction control switch signal circuit and ground.
 - If under 10 volts test for short to ground, open, high resistance or replace BCM.
3. Ignition ON, measure for 10-13 volts between traction control switch signal circuit and traction control switch ground at switch connector.
 - If under 10 volts test for open or high resistance in traction control switch ground circuit.
4. Replace traction control switch.

Component Testing

Disconnect traction control switch connector. Connect a DMM between terminals of switch. Press switch and verify there is continuity.

- If there is no continuity replace switch.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References for EBCM, IPC and BCM replacement, setup and programming

VEHICLE STABILITY ENHANCEMENT SYSTEM POOR PERFORMANCE**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic

procedure.

- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Circuit/System Description

Proper operation of the Vehicle Stability Enhancement System (VSES) is highly dependent on the ability to apply brake pressure to a selected wheel, through the brake pressure modulator valve (BPMV), as commanded by the electronic brake control module (EBCM). The EBCM may not be able to detect certain mechanical failures that may cause the VSES to perform poorly. This diagnostic procedure is designed to help diagnose concerns of poor vehicle stability that may occur without the presence of any DTCs, by verifying the following.

- The tires are the correct size, properly inflated and in acceptable condition.
- There are no mechanical problems in the steering system.
- There are no mechanical problems in the suspension system.
- There are no mechanical problems in the base brake system.
- There are no mechanical problems in the locking differential or transfer case.
- All of the VSES related hydraulic controls within the BPMV are functioning correctly.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Symptoms - Antilock Brake System**
- **Symptoms - Hydraulic Brakes**
- **Symptoms - Steering Wheel and Column**
- **Symptoms - Suspension General Diagnosis**

REPAIR INSTRUCTIONS

ANTILOCK BRAKE SYSTEM AUTOMATED BLEED PROCEDURE

CAUTION: Refer to **Brake Fluid Irritant Caution** .

NOTE: Refer to **Brake Fluid Effects on Paint and Electrical Components Notice** .

IMPORTANT: Before performing the ABS Automated Bleed Procedure, first perform a pressure bleed of the base brake system. Refer to

Hydraulic Brake System Bleeding (Manual) or Hydraulic Brake System Bleeding (Pressure) . The automated bleed procedure is recommended when one of the following conditions exist:

- **Base brake system bleeding does not achieve the desired pedal height or feel.**
- **Extreme loss of brake fluid has occurred.**
- **Air ingestion is suspected in the secondary circuits of the brake modulator assembly.**

The ABS Automated Bleed Procedure uses a scan tool to cycle the system solenoid valves and run the pump in order to purge any air from the secondary circuits. These circuits are normally closed off and are only opened during system initialization at vehicle start up and during ABS operation. The automated bleed procedure opens these secondary circuits and allows any air trapped in these circuits to flow out toward the brake corners.

Performing the Automated Bleed Procedure

NOTE: **The Auto Bleed Procedure may be terminated at any time during the process by pressing the EXIT button. No further Scan Tool prompts pertaining to the Auto Bleed procedure will be given. After exiting the bleed procedure, relieve bleed pressure and disconnect bleed equipment per manufacturers instructions. Failure to properly relieve pressure may result in spilled brake fluid causing damage to components and painted surfaces.**

1. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
2. Remove all four tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** .
3. Inspect the brake system for leaks and visual damage. Refer to **Symptoms - Hydraulic Brakes** . Repair or replace components as needed.
4. Lower the vehicle.
5. Inspect the battery state of charge. Refer to **Battery Inspection/Test** .
6. Install a scan tool.
7. Turn the ignition ON, with the engine OFF.
8. With the scan tool, establish communications with the ABS system. Select Special Functions. Select Automated Bleed from the Special Functions menu. The Automated Bleed function will take 5 to 20 seconds.
9. Follow any screen instructions.

10. Remove the scan tool.
11. Raise and support the vehicle. Refer to **Lifting and Jacking the Vehicle** .
12. Following the directions given on the scan tool, pressure bleed the base brake system. Refer to **Hydraulic Brake System Bleeding (Manual)** or **Hydraulic Brake System Bleeding (Pressure)** .
13. Follow the scan tool directions until the desired brake pedal height is achieved.
14. If the bleed procedure is aborted, a malfunction exists. Perform the following steps before resuming the bleed procedure:
 - If a DTC is detected, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** and diagnose the appropriate DTC.
 - If the brake pedal feels spongy, perform the conventional brake bleed procedure again. Refer to **Hydraulic Brake System Bleeding (Manual)** **Hydraulic Brake System Bleeding (Pressure)** .
15. When the desired pedal height is achieved, press the brake pedal to inspect for firmness.
16. Lower the vehicle.
17. Remove the scan tool.
18. Install the tire and wheel assemblies. Refer to **Tire and Wheel Removal and Installation** .
19. Inspect the brake fluid level. Refer to **Master Cylinder Reservoir Filling** .
20. Road test the vehicle while inspecting that the pedal remains high and firm.

ELECTRONIC BRAKE CONTROL MODULE REPLACEMENT

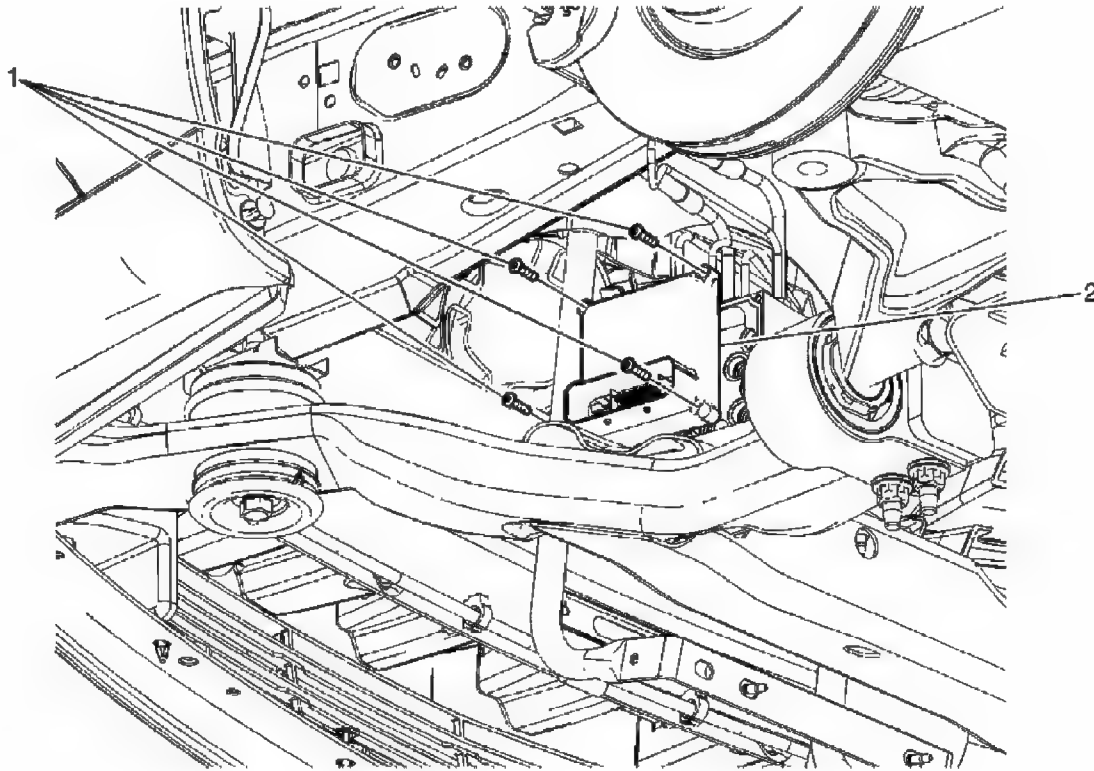


Fig. 19: Identifying Electronic Brake Control Module
Courtesy of GENERAL MOTORS CORP.

Electronic Brake Control Module Replacement

Callout	Component Name
<p>NOTE: Always connect or disconnect the wiring harness connector from the EBCM/EBTCM with the ignition switch in the OFF position. Failure to observe this precaution could result in damage to the EBCM/EBTCM.</p> <p>NOTE: Refer to <u>Fastener Notice</u> .</p> <p>Fastener Tightening Specifications: Refer to <u>Fastener Tightening Specifications</u>.</p> <p>Preliminary Procedures</p> <ol style="list-style-type: none"> 1. Raise and support the vehicle. Refer to <u>Lifting and Jacking the Vehicle</u> . 2. Remove the left front tire and wheel. Refer to <u>Tire and Wheel Removal and Installation</u> . 3. Remove the left front inner wheelhouse liner. Refer to <u>Front Wheelhouse Liner Replacement</u> . 	
	Electronic Brake Control Module Bolts (Qty: 4)

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1	<p>Tip:</p> <ul style="list-style-type: none">• Remove the electrical connector from the electronic brake control module.• If a new electronic brake control module is installed, you must program the electronic brake control module. Refer to <u>Service Programming System (SPS)</u> . <p>Tighten: 3 N.m (27 lb in)</p>
2	<p>Electronic Brake Control Module</p> <p>Tip: Clean the sealing surface of the brake pressure modulator valve with denatured alcohol and a clean shop cloth.</p> <p>Refer to <u>Control Module References</u> for programming and setup information.</p>

BRAKE PRESSURE MODULATOR VALVE REPLACEMENT

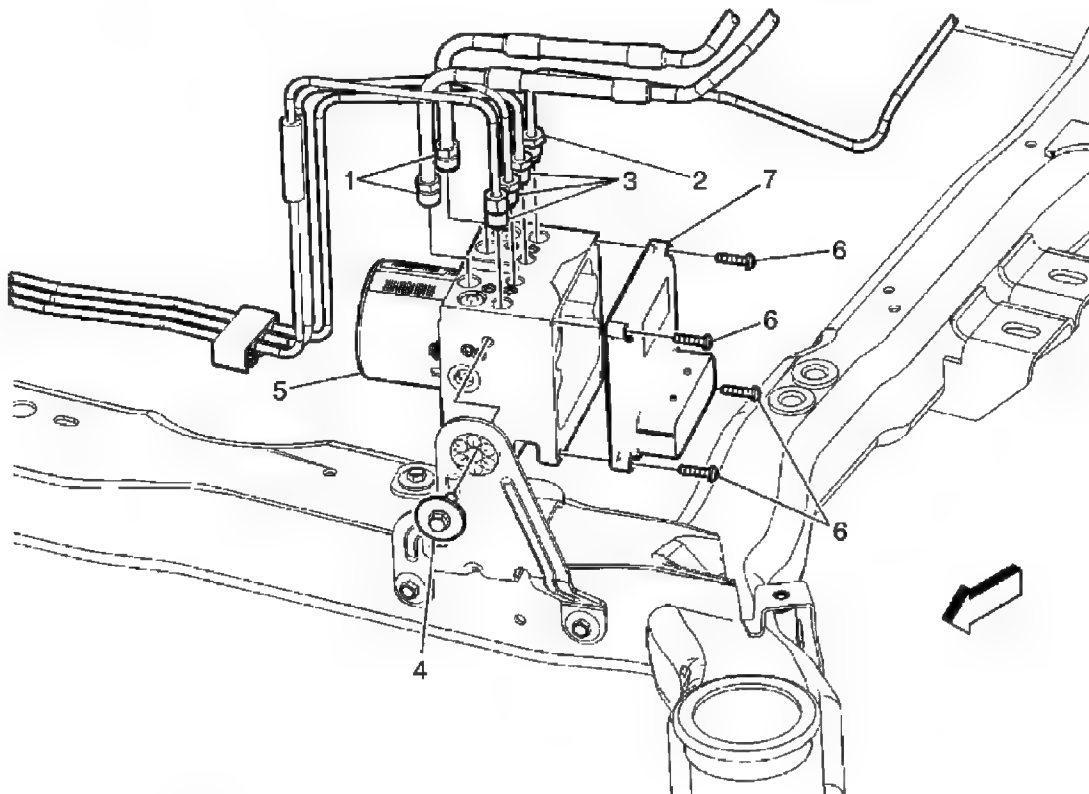


Fig. 20: Locating Brake Pressure Modulator Valve Components
Courtesy of GENERAL MOTORS CORP.

Brake Pressure Modulator Valve Replacement

Callout	Component Name

CAUTION:

Refer to Brake Fluid Irritant Caution .

NOTE:

Refer to Brake Fluid Effects on Paint and Electrical Components Notice .

Preliminary Procedures

1. Remove the left front wheelhouse liner. Refer to Front Wheelhouse Liner Replacement .
2. Disconnect the electrical connector at the electronic brake control module.

1	<p>Fittings, Brake Pipe - Master Cylinder (Qty: 2)</p> <p>NOTE: Refer to <u>Fastener Notice</u> .</p> <p>Tighten: 27 N.m (20 lb ft)</p> <p>Tip:</p> <ul style="list-style-type: none"> • Cap the brake pipe fittings to prevent fluid loss and contamination. • Finger tighten the brake pipe fittings before tightening to the final torque specification.
2	<p>Fitting, Brake Pipe</p> <p>Tighten: 18 N.m (13 lb ft)</p> <p>Tip:</p> <ul style="list-style-type: none"> • Cap the brake pipe fitting to prevent fluid loss and contamination. • Finger tighten the brake pipe fittings before tightening to the final torque specification.
3	<p>Fittings, Brake Pipe (Qty: 3)</p> <p>Tighten: 18 N.m (13 lb ft)</p> <p>Tip:</p> <ul style="list-style-type: none"> • Cap the brake pipe fitting to prevent fluid loss and contamination. • Finger tighten the brake pipe fittings before tightening to the final

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	torque specification.
4	Bolt, Brake Pressure Modulator Valve (BPMV) to Bracket Tighten: 10 N.m (89 lb in)
5	Valve, Brake Pressure Modulator (BPMV) Tip: DO NOT separate the BPMV from the electronic brake control module (EBCM) until out of the vehicle on a work bench.
6	Screws, EBCM to BPMV (Qty: 4) Tighten: 3 N.m (27 lb in)
7	Module, Electronic Brake Control (EBCM) Tip: <ul style="list-style-type: none">• If equipped with a brake fluid pressure sensor, connect the electrical connector.• Fill the brake master cylinder reservoir. Refer to <u>Master Cylinder Reservoir Filling</u> .• Bleed the hydraulic brake system. Refer to <u>Hydraulic Brake System Bleeding (Manual)</u> or <u>Hydraulic Brake System Bleeding (Pressure)</u> .• Perform the automated bleed procedure. Refer to <u>Antilock Brake System Automated Bleed Procedure</u>.• Perform the system check - vehicle. Refer to <u>Diagnostic System Check - Vehicle</u> .

BRAKE PRESSURE MODULATOR VALVE BRACKET REPLACEMENT

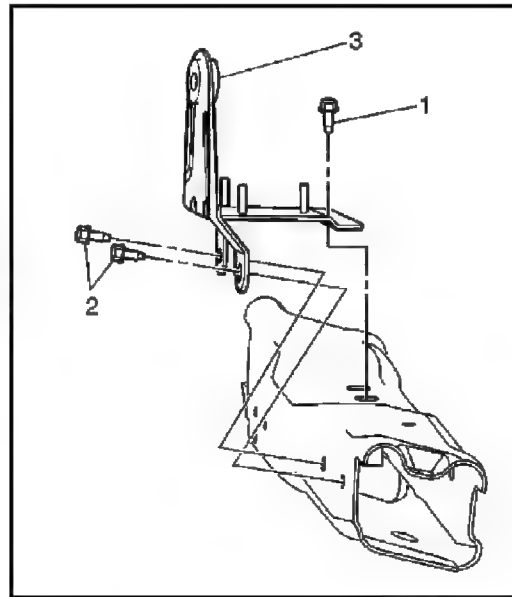
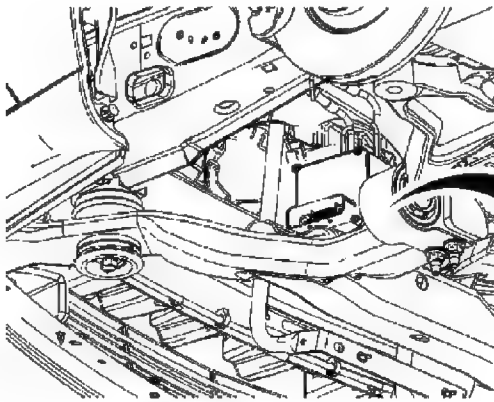


Fig. 21: Removing/Installing Brake Pressure Modulator Valve (BPMV) Bracket
Courtesy of GENERAL MOTORS CORP.

Brake Pressure Modulator Valve Bracket Replacement

Callout	Component Name
Preliminary Procedure: Remove the brake pressure modulator valve (BPMV). Refer to <u>Brake Pressure Modulator Valve Replacement</u>	
1	Brake Pressure Modulator Valve (BPMV) Mounting Bolt - Upper NOTE: Refer to <u>Fastener Notice</u> . Tighten: 12 N.m (106 lb ft)
2	BPMV Mounting Bolt - Lower (Qty: 2) Tighten: 12 N.m (106 lb ft)
3	BPMV Bracket

ELECTRONIC TRACTION CONTROL SWITCH REPLACEMENT

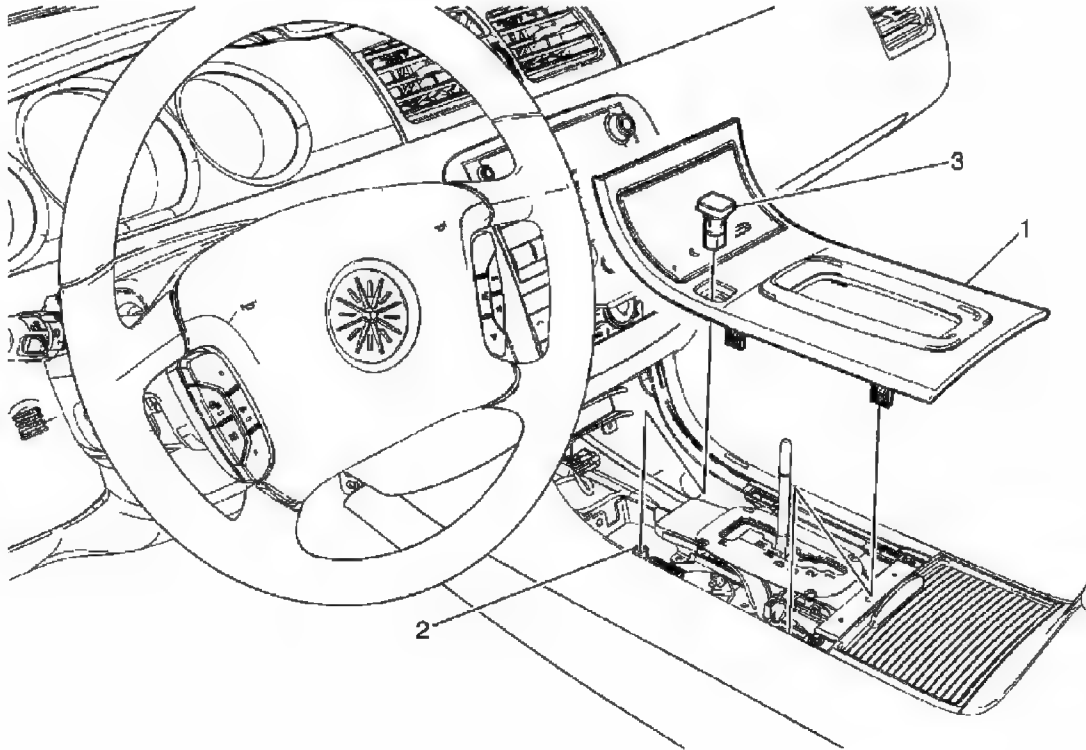


Fig. 22: Identifying Electronic Traction Control Switch
Courtesy of GENERAL MOTORS CORP.

Electronic Traction Control Switch Replacement

Callout	Component Name
Preliminary Procedure: IMPORTANT: The traction control switch on column shift equipped vehicles is integral to the shift lever. To replace the traction control switch on column shift equipped vehicles, refer to <u>Shift Lever Replacement</u> .	
Remove the floor shift control knob. Refer to <u>Floor Shift Control Knob Replacement</u> .	
1	Plate, Front Floor Console Trim Tip: Lift the rear edge of the front floor console trim plate using a flat-bladed, plastic tool to release the 4 retaining clips.
2	Connector, Traction Control Switch Electrical
3	Switch, Traction Control Tip: Press the retaining tabs to release the traction control switch from the front floor console trim plate.

VEHICLE YAW SENSOR WITH VEHICLE LATERAL ACCELEROMETER REPLACEMENT

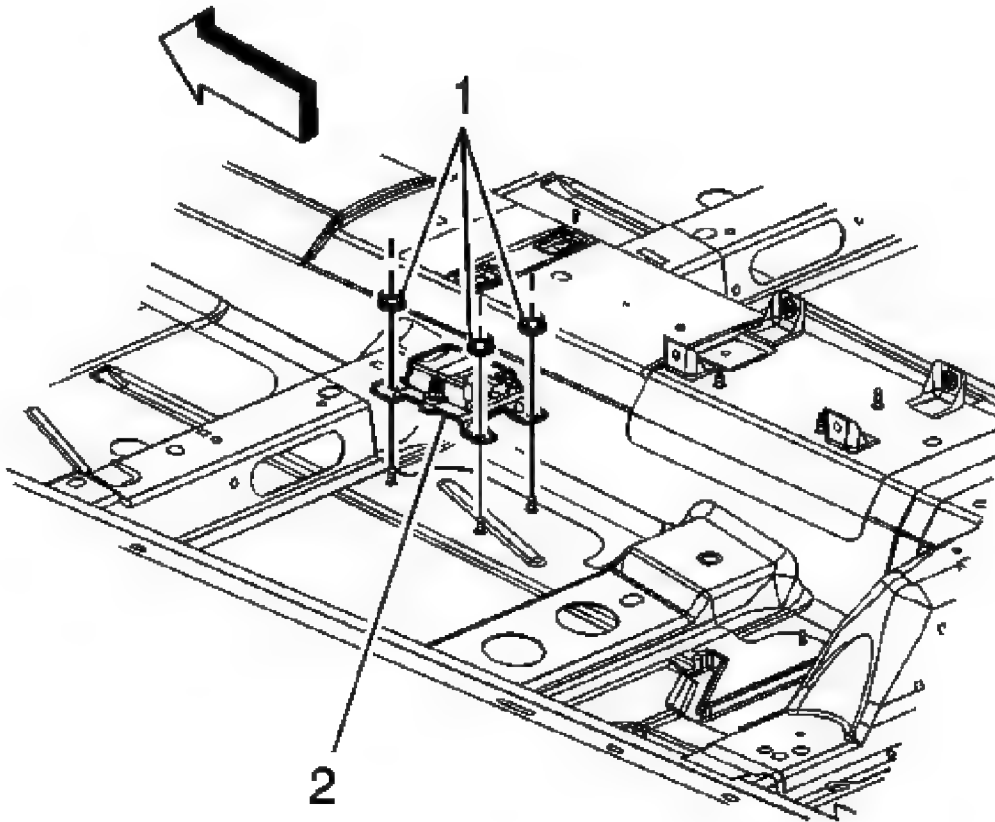


Fig. 23: Identifying Vehicle Yaw Sensor with Vehicle Lateral Accelerometer
 Courtesy of GENERAL MOTORS CORP.

Vehicle Yaw Sensor with Vehicle Lateral Accelerometer Replacement

Callout	Component Name
Preliminary Procedures	
1. Remove the drivers seat. Refer to <u>Seat Replacement</u> . 2. Disconnect the yaw rate sensor/lateral accelerometer electrical connector.	
1	Nut (Qty: 3) NOTE: Refer to <u>Fastener Notice</u> . Tighten: 9 N.m (80 lb in)

DESCRIPTION AND OPERATION

ABS DESCRIPTION AND OPERATION

This vehicle is equipped with the TRW 440 V antilock braking system.

The vehicle is equipped with the following braking systems:

- Antilock Brake System (ABS)
- Engine Drag Control (EDC)
- Dynamic Rear Proportioning (DRP)
- Traction Control System (TCS)
- Vehicle Stability Enhancement System (VSES) (w/JL4)

The following components are involved in the operation of the above systems:

- Electronic brake control module (EBCM)-The EBCM controls the system functions and detects failures.

The EBCM contains the following components:

- System relay-The system relay is energized when the ignition is ON and no ABS DTCs are present. It supplies battery positive voltage to the solenoid valves and pump motor.
- Vent tube-The vent tube, located in the EBCM connector, is an opening to the internal cavity of the EBCM. It allows ventilation of the EBCM internals.
- Brake pressure modulator valve (BPMV)-The BPMV contains the hydraulic valves and pump motor that are controlled electrically by the EBCM. The BPMV uses a 4 circuit configuration with a diagonal split. The BPMV directs fluid from the reservoir of the master cylinder to the left front and right rear wheels and fluid from the other reservoir to the right front and left rear wheels. The diagonal circuits are hydraulically isolated so that a leak or malfunction in one circuit will allow continued braking ability on the other.

IMPORTANT: There is a rubber isolator located under the BPMV and on the mounting studs. The rubber isolators protect the BPMV and the EBCM from vehicle vibrations.

The BPMV contains the following components:

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- Pump motor
- Inlet valves (one per wheel)
- Outlet valves (one per wheel)
- Master cylinder isolation valves (one per drive wheel)
- Prime valves (one per drive wheel)
- Wheel speed sensors (WSS)-As the wheel spins, the wheel speed sensor produces an AC signal. The EBCM uses this AC signal to calculate wheel speed. The wheel speed sensors are replaceable only as part of the wheel hub and bearing assemblies.
- Traction control switch-The TCS is manually disabled or enabled using the traction control switch.
- Stoplamp switch-The EBCM uses the stoplamp switch as an indication that the brake pedal is applied.
- Lateral accelerometer sensor (w/JL4)-The EBCM uses the lateral accelerometer sensor as an indication of the lateral acceleration of the vehicle.
- Yaw rate sensor (w/JL4)-The EBCM uses the yaw rate sensor as an indication of the yaw rate of the vehicle.
- Steering wheel position sensor (SWPS) (w/JL4)-The EBCM uses the SWPS as an indication of the position and rotation of the steering wheel.

Initialization Sequence

The EBCM performs 1 initialization test each ignition cycle. The initialization of the EBCM occurs when 1 set of the following conditions occur:

Both of the following conditions occur:

- The EBCM detects that there is a minimum of 500 RPM from the ECM via a serial data message.
- The stop lamp switch is not applied.

OR

Both of the following conditions occur:

- The vehicle speed is greater than 16 km/h (10 mph).
- The stop lamp switch is applied.

The initialization sequence may also be commanded with a scan tool.

The initialization sequence cycles each solenoid valve and the pump motor, as well as the necessary relays, for approximately 1.5 seconds to check component operation. The EBCM

sets a DTC if any error is detected. The initialization sequence may be heard and felt while it is taking place and is considered part of normal system operation.

The EBCM defines a drive cycle as the completion of the initialization sequence.

Antilock Brake System

When wheel slip is detected during a brake application, the ABS enters antilock mode. During antilock braking, hydraulic pressure in the individual wheel circuits is controlled to prevent any wheel from slipping. A separate hydraulic line and specific solenoid valves are provided for each wheel. The ABS can decrease, hold or increase hydraulic pressure to each wheel brake. The ABS cannot, however, increase hydraulic pressure above the amount which is transmitted by the master cylinder during braking.

During antilock braking, a series of rapid pulsations is felt in the brake pedal. These pulsations are caused by the rapid changes in position of the individual solenoid valves as the EBCM responds to wheel speed sensor inputs and attempts to prevent wheel slip. These pedal pulsations are present only during antilock braking and stop when normal braking is resumed or when the vehicle comes to a stop. A ticking or popping noise may also be heard as the solenoid valves cycle rapidly. During antilock braking on dry pavement, intermittent chirping noises may be heard as the tires approach slipping. These noises and pedal pulsations are considered normal during antilock operation.

Vehicles equipped with ABS may be stopped by applying normal force to the brake pedal. Brake pedal operation during normal braking is no different than that of previous non-ABS systems. Maintaining a constant force on the brake pedal provides the shortest stopping distance while maintaining vehicle stability.

Pressure Hold

The EBCM closes the inlet valve and keeps the outlet valve closed in order to isolate the system when wheel slip occurs. This holds the pressure steady on the brake so that the hydraulic pressure does not increase or decrease.

Pressure Decrease

The EBCM decreases the pressure to individual wheels during a deceleration when wheel slip occurs. The inlet valve is closed and the outlet valve is opened. The excess fluid is stored in the accumulator until the return pump can return the fluid to the master cylinder.

Pressure Increase

The EBCM increases the pressure to individual wheels during a deceleration in order to reduce the speed of the wheel. The inlet valve is opened and the outlet valve is closed. The increased pressure is delivered from the master cylinder.

Engine Drag Control (EDC)

When the driver releases the throttle and the drag from the engine overcomes the frictional force between the tire and the road, EDC becomes active.

The EBCM sends a torque request signal to the ECM, which increases the torque at the wheels. This stabilizes the wheels by reducing the slip at the driven wheels.

When EDC is active, the driven wheels are controlled to a target below the non-driven wheels.

Dynamic Rear Proportioning (DRP)

The dynamic rear proportioning (DRP) is a control system that replaces the hydraulic proportioning function of the mechanical proportioning valve in the base brake system. The DRP control system is part of the operation software in the EBCM. The DRP uses active control with existing ABS in order to regulate the vehicle's rear brake pressure.

The red brake warning indicator is illuminated when the dynamic rear proportioning function is disabled.

Traction Control System (TCS)

When drive wheel slip is noted while the brake is not applied, the electronic brake control module (EBCM) will enter traction control mode.

First, the EBCM requests the engine control module (ECM) to reduce the amount of torque to the drive wheels via the serial data. The ECM reduces torque to the drive wheels by retarding spark timing and turning off fuel injectors. The ECM reports the amount torque delivered to the drive wheels via the serial data circuit.

If the engine torque reduction does not eliminate drive wheel slip, the EBCM will actively apply the drive wheel brakes. During traction control braking, hydraulic pressure in each drive wheel circuit is controlled to prevent the drive wheels from slipping. The master cylinder isolation valve closes in order to isolate the master cylinder from the rest of the hydraulic system. The prime valve then opens in order to allow the pump to accumulate brake fluid in order to build hydraulic pressure for braking. The drive wheel inlet and outlet solenoid valves then open and close in order to perform the following functions:

- Pressure hold
- Pressure increase
- Pressure decrease

ABS Indicator

The instrument panel cluster (IPC) illuminates the Antilock Brake System (ABS) indicator

when the following occurs:

- The electronic brake control module (EBCM) detects a malfunction with the antilock brake system. The IPC receives a serial data message from the EBCM requesting illumination.
- The IPC performs the displays test at the start of each ignition cycle. The indicator illuminates for approximately 5 seconds.
- The IPC detects a loss of serial data communications with the EBCM.

Traction Control System Indicator

TRAC OFF

The instrument panel cluster (IPC) illuminates the TRAC OFF indicator when the following occurs:

- The electronic brake control module (EBCM) inhibits the traction control system due to a malfunction in the traction control system. The IPC receives a serial data message from the EBCM requesting illumination.
- The body control module (BCM) detects that the traction control switch has been pressed (signal circuit is low). The BCM sends a serial data message to the EBCM in order to disable traction control. The IPC receives a serial data message from the EBCM requesting illumination. The BCM sends a serial data message to the radio in order to activate an audible warning.

Vehicle Stability Enhancement System (VSES)

The vehicle stability enhancement system (VSES) adds an additional level of vehicle control to the EBCM.

Yaw rate is the rate of rotation about the vehicle's vertical axis. The VSES is activated when the EBCM determines that the desired yaw rate does not match the actual yaw rate as measured by the yaw rate sensor.

The desired yaw rate is calculated from the following parameters:

- The position of the steering wheel
- The speed of the vehicle
- The lateral or sideways acceleration of the vehicle

The difference between the desired yaw rate and the actual yaw rate is the yaw rate error, which is a measurement of oversteer or understeer. If the yaw rate error becomes too large, the EBCM attempts to correct the vehicle's yaw motion by applying differential braking to the appropriate wheel. The amount of differential braking applied to the left or right front wheel

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is based on both the yaw rate error and side slip rate error.

The VSES activations generally occur during aggressive driving, in turns or on bumpy roads without much use of the accelerator pedal. When braking during VSES activation, the pedal pulsations feel different than the ABS pedal pulsations. The brake pedal pulsates at a higher frequency during VSES activation.

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Special Tools

Illustration	Tool Number/Description
	J 39200 Digital Multimeter (DMM)

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